LIFE

LETTERS AND JOURNALS

OF

SIR CHARLES LYELL, BART.

AUTHOR OF 'PRINCIPLES OF GEOLOGY' &C.

EDITED BY HIS SISTER-IN-LAW, MRS. LYELL

LONDON
JOHN MURRAY, ALBEMARLE STREET
1881

All rights reserved

PREFACE.

The Geological Works of Sir Charles Lyell are the best monument which he has left to the world as a record of his labours in Science, but something more may be desired to be known of the life of one who loved Nature's works with an intensity which was only equalled by his love of Truth.

These volumes contain a sketch of the early days of Geological Science, and of the Geological Society of London, with glimpses of some of the bright characters who adorned it.

An autobiographical account of his boyhood is given, and large extracts from the private journals and letters to his wife, his family and friends, as these record better than any panegyric the untiring energy and enthusiasm which never flagged during a long life, rendering it a useful and a very happy one.

His cultivated mind and classical taste, his keen interest in the world of politics and in the social progress and education of his country, and the many opportunities he enjoyed of friendly intercourse with the most leading characters of his age, make the letters

abound in lively anecdotes and pictures of society, constantly interspersed with his enthusiastic devotion to Natural History.

The geological information is given, as he gathered it in, from his personal observations at the time, though he afterwards may have arrived at different conclusions as he advanced in the study of the subject.

Many thanks are due to all who have kindly lent me their letters, and have thus contributed to the completion of these memoirs.

CONTENTS

OF

THE FIRST VOLUME.

CHAPTER I.

NOVEMBER 1797—1812–14.

PAGE

Birth at Kinnordy—Bartley Lodge—School at Ringwood—Adventures—School-life at Salisbury—Old Sarum—More School Adventures—Entomology—Dr. Fowler—Ill, and sent Home—Love of Insects—Dr. Bayley's School at Midhurst—Reflections on School-life—Classicus Paper—Taste for Poetry—Latin Verses—Petty Gambling—Chess—Music—The enraged Musician—Cowdry Park and Birds-nesting 1

CHAPTER II.

FEBRUARY 1816—NOVEMBER 1817.

Letters from Oxford—Fellow Students—Gifford—Kirke White—'Christabel'—Examination—Lord Exmouth—Ammonites Bucklandi—Visit to Mr. Dawson Turner at Yarmouth—Dr. Arnold—Geology—Journey to Scotland—Trip to Staffa—Iona—Return to Oxford—Lines on Staffa 32

CHAPTER III.

JUNE, JULY 1818.

Tour on the Continent—Paris—Jardin des Plantes—Versailles—Malmaison—Théâtre Français—Corneille's Play—Practical Efficiency of the Bibliothèque du Roi—Visit to Père la Chaise—The Louvre—Journey continued to the Jura Mountains—Grand View over Switzerland—Chamouni—Glacier de Bossons—Mer de Glace—Couvercle, and le Jardin—Flowers and Insects—Return to Geneva—Basle—Holbein—Falls of Schaffhausen—Lucerne—Ascent of the Righi 57

CHAPTER IV.

JULY—SEPTEMBER 1818.

PAGE

Meyringen—The Giesbach—Glacier of the Rhone—View from the Grimsel—Theory of Pink Snow explained—Grindelwald Glacier—La belle Battelière—Avalanche from the Eiger—Berne and Dr. Wittenbach—The Vallais—Desolation from the bursting of the Drance—Val de Bagne—The Bridge of Lourtier—Convent of St. Bernard—Ancient Temple of Jupiter—Brieg—The Simplon—Lago Maggiore—Milan—Verona—Venice—Bologna—Florence 84

CHAPTER V.

SEPTEMBER 1820—JULY 1823.

Letter from Rome—Impressions of the Forum—Political Discontent at Naples—Geological Anniversary Dinner—Geologising in Surrey—Visit to Romney Marsh—Geology of the Isle of Wight—Geological Club Dinner—Paris—Soirée at Cuvier's—Alexander von Humboldt—La Place—Arago—Politics—Aliments for ever 112

CHAPTER VI.

JULY 1823—OCTOBER 1824.

Alexander Brongniart — Manufacture of Sèvres—M. Pichon—Tertiary Formations at Meudon—M. Constant Prévost—Marshal Soult's Gallery—Political Discussion at Cuvier's—Excursion to Fontainebleau with M. Constant Prévost—Division of Property—Baron de Férussac—His Cosmogony—Political Changes in France—Versailles—Geological Excursion to the Marne—Centralisation of Paris—Return to England—Rev. W. D. Conybeare—Plesiosaurus from Lyme Regis—Constant Prévost's Visit to England—Kinnordy—Accompanies Dr. Buckland to Ross-shire 132

CHAPTER VII.

JULY 1825—DECEMBER 1827.

Clathrarium Lyelli—Entomology—Lockhart becomes Editor of the 'Quarterly Review'—Breakfast at Lockhart's with Sir Walter Scott—Visit to Cambridge—Pleasure in reading Lamarck—Planning his future Work—On Intolerance in Science 160

CHAPTER VIII.

JANUARY—SEPTEMBER 1828.

Arrival of Ava Fossils—Botanical Chair, London University—Dr. Fleming's History of British Animals—Party at Sir George Phillips'—Tour

PAGE

abroad with Murchison—Paris—Journey to Auvergne—Secondary and Freshwater Formations of France—Volcanic Phenomena near Clermont—Count de Montlosier—Beautiful Scenery about Mont Dor—Cantal Fossils — Entomology — Nice — Murchison Overtaxing his Strength—Paper on Excavation of Valleys—Determines to go to Naples and Sicily—Letter to Herschel—Parts from the Murchisons at Padua —Giotto's Paintings 175

CHAPTER IX.

OCTOBER 1828—JANUARY 1829.

Parma—Professor Guidotti—Fine Collection of Fossil Shells—Adventure at the Douane at Parma—Geology of the Valley of the Elsa River near Siena—Ancient Volcanos near Viterbo—Geology of Rome—Naples—Embarks for Ischia—Pæstum—Temple of Neptune—Catania—Ascent of Etna—The Casa Inglese—The Gemmellaros—Hardships and Adventures—Syracuse—Agrigentum — A Festa — Palermo—Banditti —Difficulty of leaving Sicily—Return to Naples 205

CHAPTER X.

JANUARY—DECEMBER 1829.

Rome—News from home on Geological speculations—Dr. Wollaston's Death—Tivoli—Grand section of Travertin—Geologists at Genoa—Journey to Geneva—De Candolle—Necker—Paris—Lecture of Prévost's—Cuvier—Arrangement of his Library—Return to London—Lively Meeting at the Geological Society—Fossils in pavement-stone in Forfarshire—Sedgwick and Murchison geologising abroad—Letter from Constant Prévost—Project of going to Iceland 236

CHAPTER XI.

FEBRUARY—AUGUST 1830.

Dr. Fleming's remarks on Conybeare—Determination not to enter into controversy—Opening of the Athenæum Club—Milman's 'History of the Jews'—Proposed trip to the Crimea—Letters to Poulett Scrope on the 'Principles'—Leaves England with Captain Cooke for the Pyrenees—Excursion into Catalonia 259

CHAPTER XII.

AUGUST—NOVEMBER 1830.

Volcanos of Olot—Earthquakes—Count d'Espagne—Cork-trees on the French side of the Pyrenees—Pine-trees—Political state of the country—Expedition to Mont Perdu—Letter to Scrope on Geology—Ripple-mark—Paris—Louis Philippe—Political agitation in Belgium

PAGE

and France—Studying shells with Deshayes—Disturbance by the mob—Returns to London—Scrope's review in 'Quarterly'—Removes to Raymond Buildings 283

CHAPTER XIII.

FEBRUARY—SEPTEMBER 1831.

Appointed Professor of Geology at King's College—Visit to Cambridge—Journal to Miss Horner—Mrs. Somerville's 'Mechanism of the Heavens'—Party spirit on the Reform Bill—On Education of Boys—Madame de Staël and her Writings—Sir William Napier—Goes to Scotland—Edinburgh—Lord Cockburn—Dr. Greville—Kinnordy . 315

CHAPTER XIV.

SEPTEMBER—DECEMBER 1831.

New Volcanic Island in the Mediterranean—Life at Kinnordy with his family—Election excitement—Murray of Simprim—Returns to London—Dinner at the Linnæan Club—Cumming, the sail-maker—Geological Society Meeting—Duke of Sussex at the Royal Society—Visit to Jermyns—Thinks of giving up his Professorship at King's College 339

CHAPTER XV.

JANUARY—MAY 1832.

Conversation with Babbage—Mrs. Lockhart—Visit to Dr. Fitton at Hendon—Dinner at Mr. Mallet's at Hampstead—Entomology—Anniversary Dinner of the Geological Society—Party at Murchison's—Sedgwick declines a Living—Captain Basil Hall—Zoological farm at Kingston Hill—Butterflies—On Religious Toleration—Lectures at King's College—Reform Bill 361

CHAPTER XVI.

JUNE 1832—APRIL 1834.

His Marriage—Tour to Switzerland and the Italian Lakes—Return to London—Lectures at the Royal Institution—Heidelberg—Von Leonhard's Lecture—Dr. Schmerling's work in the Caves near Liège—Dr. Bowstead—Sydney Smith—The Drummond Light 387

CHAPTER XVII.

MAY—JUNE 1834.

Departs for Sweden—Lübeck—Picks up Shells on the Baltic—Arrives at Copenhagen—Expedition to Möen with Dr. Forchhammer—The Crown

PAGE

Prince Christian—Visit to the Country Palace of Sorgen-frey—Geology—Departs for Sweden—Engages an Interpreter—Legend of the Bäcke-hästen—Castle of Kalmar 407

CHAPTER XVIII.

JUNE—DECEMBER 1834.

Stockholm—Berzelius—Review of the Fleet by Prince Oscar—Upsala—Herr Adjuncter Marklin—Linnæus' Garden—Liber Argenteus—Measures the Sea-level—Returns to Stockholm—Gotheborg—Sails to Hull—Edinburgh Scientific Meeting—Agassiz 425

CHAPTER XIX.

JANUARY—DECEMBER 1835.

Buckland's Bridgewater Treatise—Crag shells of Suffolk—Paris—Von Buch—Berzelius—Geology of Switzerland—Meeting of Naturalists at Bonn—Agassiz' Catastrophe System—His Love of Natural History—Deshayes' zeal for Conchology 444

CHAPTER XX.

FEBRUARY—DECEMBER 1836.

On money for Museums being frittered away in Buildings—Letter to Sir John Herschel on the Origination of New Species - Kinnordy—Dr. Fleming appointed Professor in Aberdeen—Dr. Fitton declines Presidentship of the Geological Society—Letter to Darwin against his undertaking official work 462

LIST OF PLATES.

Portrait of Sir Charles Lyell, after a Crayon Drawing by George Richmond, R.A. . . . . *Frontispiece.*

Kinnordy, Forfarshire, the Birthplace of Sir Charles Lyell . *To face p.* 1.

CHAPTER XXI.

MARCH—NOVEMBER 1837.

PAGE

octrine of Uniformity—Dinner at Miss Rogers'—Babbage's Ninth Bridgwater Treatise—Letter to Herschel on Coral Islands—Copenhagen—Invention of Electric Telegraph—Visit to Sorgen-fri—Norway—Geology—Paris—Von Buch—Mademoiselle Mars—New railroad—Barrière de l'Etoile—Return to London—Parties . . . .

CHAPTER XXII.

JANUARY 1838—OCTOBER 1841.

'Elements of Geology'—Sedgwick's Lecture—Whewell's 'Inductive Sciences'—Anniversary at the Geological Society—Darwin on Volcanic Phenomena—Visit to Norwich and Yarmouth—Newcastle Meeting—Darwin's Journal—Coral Reefs—Athenæum Club—Dr. Fitton's Review—Hutton's claims—British Association at Birmingham—Visit to Sir Robert Peel—Travelling in the United States—Rapid growth of the country—Niagara geology 35

CHAPTER XXIII.

JUNE 1842—DECEMBER 1843.

Niagara—Nova Scotia—Subterranean Forest—Unfair statements on the United States—Return to England—Contemplates writing a Journal of his impressions of America—Much geological work in prospect—Giant's Causeway—Lord Rosse's Telescope—Prescott's Mexico . 60

CHAPTER XXIV.

JANUARY 1844—DECEMBER 1846.

PAGE

Letter to Mr. Ticknor on America—Fossil Botany—Goes with Faraday on a Commission of Inquiry on Accidents in Collieries—Blanco White's Biography—Newfoundland—Politics in Maine—Vegetation in Georgia—Slavery—Cheirotherium—Icebergs—Letter to Edward Forbes, and reply—Dinner at Milman's—Visit to Bowood 83

CHAPTER XXV.

FEBRUARY 1847—SEPTEMBER 1848.

Anniversary at Geological Society—Editorship of the 'Edinburgh Review'—Call on Rogers—His remarks on Historians—Breakfast with him—Chapter on Universities in 'Second Travels'—Rare Books—British Association, Oxford—Linnæa Borealis—Decay of the Drama—Hugh Miller's 'First Impressions of England'—Visit to Bowood—Party at Sir Robert Peel's—Meeting at Royal Society—Knighthood—Dinner with the Archbishop of Dublin 120

CHAPTER XXVI.

JANUARY 1849—JULY 1851.

Dr. Hooker in India—Macaulay's 'History of England'—Tour on Deeside—Visit to Sir James Clark—Balmoral—Ticknor's 'History of Spanish Literature'—Visit to Germany—Botany of the Hartz—Geology of Saxony—Letters of Ignatius—Prejudice against Science—Tractarianism—Lecture at Ipswich—Exhibition in Hyde Park—Raffael's Cartoons. 152

CHAPTER XXVII.

FEBRUARY 1852—NOVEMBER 1854.

Departure for America—Electric Cable—Geology in Nova Scotia and New Brunswick—Visit to Sir Edmund and Lady Head—Expedition to Vermont—New York Exhibition—Visit to Osborne—Madeira—Geology—Wonderful Orchid 176

CHAPTER XXVIII.

JANUARY 1855—AUGUST 1856.

Death of Edward Forbes—Berlin—Dr. Hooker's Introduction to 'Flora Indica'—Hugh Miller—Entomology—Macaulay and Prescott's Histories

PAGE

—Fossil Botany—On the Doctrine of Species—Siberia—Riesengebirge —Botany—Geology of Saxon Switzerland—Barrande's 'colony' of Upper Silurian fossils 201

CHAPTER XXIX.

SEPTEMBER 1856—AUGUST 1857.

Geology of the neighbourhood of Vienna—Styria—Salzburg—Discussion with Heer at Zürich—Fossiliferous quarry at Swanage—Visit to Switzerland—Fossil Plants—Elie de Beaumont's frank opposition . 227

CHAPTER XXX.

AUGUST 1857—SEPTEMBER 1857.

Leaves Zürich to see the Limestone Quarries at Soleure—Glacial phenomena in Switzerland—The Rhone Glacier—Zermatt—Viesch—The Matterhorn 248

CHAPTER XXXI.

SEPTEMBER 1857—DECEMBER 1857.

Turin—Geology of the neighbourhood—Evidence of Glacial action—Vegetation of the Riviera—Zwerglethurm near Viesch—Visit to Leghorn —Tomb of Francis Horner—Mrs. Somerville at Florence—Naples—Rome—The Campagna 263

CHAPTER XXXII.

JANUARY 1858—SEPTEMBER 1858.

Indian Mutiny—Dinner at Milman's—Sir Henry Holland—Rajah Brooke—Buckle's 'History of Civilisation'—Death of Dr. Fleming—Meeting at the Geological Society—Death of Robert Brown—Lac de Bourget—Politics with Signor Bezzi—Naples—Expedition to Vesuvius—Festa —Messina—Catania 278

CHAPTER XXXIII.

SEPTEMBER 1858—OCTOBER 1858.

Aderno—Procession of Monks—Casa Inglese on Etna—Rough quarters—Val del Bove—Descent of the Balzo di Trifoglietto—Comet—Fine Climate compensates for the drawbacks in Sicily 302

CHAPTER XXXIV.

FEBRUARY 1859—NOVEMBER 1860.

PAGE

Agassiz Museum—Owen on the Gorilla—Death of Mr. William Prescott—Lord Lyndhurst—Mansel's Bampton Lectures—British Association, Aberdeen—Darwin's 'Origin of Species'—Birthday Party—Death of Macaulay—Dawson's 'Archaia'—Flint implements in the Valley of the Somme—Death of Chevalier Bunsen 318

CHAPTER XXXV.

APRIL 1861—DECEMBER 1862.

Excursion to Bedford where Flint implements had been found—Offer of Candidature of M.P. for University of London—Kreuznach—Fossil Botany—Meeting at Philosophical Club—Death of Prince Albert—Letter on the Prince Consort—Anniversary dinner at Geological Society—Curtis the Entomologist 343

CHAPTER XXXVI.

MARCH 1863—AUGUST 1863.

On Transmutation of Species—Lamarck—Visit to Osborne—Museum of the young Princes—Interesting Conversation with the Queen—'Antiquity of Man'—Welwitschia—Expedition to Wales—Moel Tryfaen 361

CHAPTER XXXVII.

FEBRUARY 1864—NOVEMBER 1865.

Scheme for Cave explorations in Borneo—Duke of Argyll on Variation of Species—Berlin—The Crown Princess—Croll on change of Climate during geological epochs—Earth-pyramids at Botzen—Heer's 'Urwelt der Schweiz'—Letter to Mr. Spedding on the American War—Sir John Herschel's drawings of the Earth-pillars 381

CHAPTER XXXVIII.

JANUARY 1866—APRIL 1868.

On geological changes of Climate—Ticknor's 'Spanish Literature'—The Inquisition bearing on Natural Selection—Duke of Argyll's 'Reign of Law'—Mr. Darwin on 'Variation of Animals and Plants under Domestication'—Reminiscences of Faraday 406

CHAPTER XXXIX.

APRIL 1868—NOVEMBER 1868.

PAGE

Anniversary Meeting at Greenwich Observatory—Mr. Dawson's 'Acadia'—Buckle and Motley—Visit to Tenby—On Natural Selection, and the meaning of colour in birds—Visit to St. David's—Submerged forest near Tenby—On the Law of Continuity 423

CHAPTER XL.

APRIL 1869—FEBRUARY 1875.

Geology on the coast of Norfolk—Mr. Wallace's review on Natural Selection—Glaciers scooping out Lake Basins—Fossil Flora of Alaska—Life of Daniel Webster—Death of Lady Lyell—Forfarshire geology—Mr. Judd on Geology of Mull—Death of Sir Charles Lyell—Dr. Hooker's Letter—Funeral—Westminster Abbey—Tribute 438

APPENDIX.

A. Letter from Captain Basil Hall, R.N., to Leonard Horner, Esq., on the 'Prineiples of Geology,' vol. i. p. 376 465

B. Tribute to the Memory of Lady Lyell, by George S. Hillard, Esq. vol. ii. p. 451 467

C. Tributes to Sir Charles Lyell, vol. ii. p. 463 470

D. Bequest to the Geological Society 477

E. Geological Papers and Works by Sir Charles Lyell 479

INDEX 483

LIST OF PLATES.

Portrait of Sir Charles Lyell, after a Photograph by Maull and Polyblank *Frontispiece.*

Portrait of Lady Lyell, after a Crayon Drawing by George Richmond, R.A. *To face page* 285.

LETTERS AND JOURNALS

OF

SIR CHARLES LYELL, BART.

CHAPTER I.

NOVEMBER 1797—1812–14.

BIRTH AT KINNORDY—BARTLEY LODGE—SCHOOL AT RINGWOOD—ADVENTURES — SCHOOL-LIFE AT SALISBURY — OLD SARUM — MORE SCHOOL ADVENTURES—DR. FOWLER—ILL, AND SENT HOME—LOVE OF INSECTS —DR. BAYLEY'S SCHOOL AT MIDHURST—REFLECTIONS ON SCHOOL LIFE —CLASSICUS PAPER — TASTE FOR POETRY — LATIN VERSES — PETTY GAMBLING—CHESS—MUSIC—THE ENRAGED MUSICIAN—COWDRY PARK AND BIRD-NESTING.

[Charles Lyell was born November 14, 1797, at Kinnordy, the family estate in Forfarshire. He was the eldest of ten children, having two brothers and seven sisters, who all grew up. His father was a man of cultivation and refinement, and had both literary and scientific tastes. In early life he devoted himself to Botany, especially to the cryptogams, and latterly took up the study of Dante, and published several works on, and translations from, the great poet. His mother, the daughter of Thomas Smith, of Maker Hall, Swaledale, Yorkshire, was gifted with strong sense, and a tender anxiety for the welfare of her children.

In 1832 he married the eldest daughter of Mr. Leonard Horner, F.R.S., and in his letters to her, when she was living abroad at Bonn on the Rhine, he wrote at her request the following autobiography, which only extends to near the end of his school-days.]

AUTOBIOGRAPHY.

I WAS born November 14, 1797, at Kinnordy.[1] 'The front of heaven was *not* full of fiery shapes, at my nativity,' but it was a remarkable winter and spring, so warm that my mother slept all night with her bedroom windows open—which no doubt portended something remarkable in the bairn; and sure enough he was pronounced to be the loudest and most indefatigable squaller of all the brats in Angus, and while he kept others awake all night by his noise, thrived the while most vigorously. Besides this, it was more than twelve months before I cut a single tooth, and some old woman in Southampton, finding that my gums were very hard, and that I could eat well, very considerately tried to persuade my mother that her first-born would *never have any teeth!*

But I have travelled to Hants too fast. At the age of three months, I was taken on a tour to Inverary, afterwards to Ilfracombe in Devon, then to Weymouth, and finally to Southampton, where Tom[2] was born. My father then took a fourteen years' lease of Bartley Lodge in the New Forest, Hants, and stayed there twenty-eight years. The first thing of which I have a very distinct remembrance is learning the alphabet. I was about three, I believe, at that time, and was four and a half when an event happened which was not likely to be forgotten. My father and mother were on their way to Kinnordy to spend a summer there, and were within a stage and a half of Edinburgh, with Tom and me in their carriage, and behind came a post-chaise with two nursemaids and the cook, with Fanny and Marianne[3] (then the baby). On a narrow road, with a steep brae above, and an equally precipitous one below, and no parapet by the roadside, a flock of sheep jumped down into the road, and frightened the horses. Away they ran, and with the chaise, man, horses and all, disappeared clean out of sight, over the brae in an instant. No one was hurt but one of the maids, whose arm was cut by the glass being broken. My father broke the upper pane of glass, and pulled Fanny and Marianne through the opening. All were afterwards got out, and while they sat by

[1] See vignette, on title-page.

[2] His next brother.

[3] His sisters.

the roadside, one maid fainting, and the other with my mother washing the blood from her arm, a chaise with two ladies and a gentleman came past, who stared on them, and went on without offering any assistance. A shepherd was more obliging. Meanwhile Tom and I were left in the carriage. We thought it fine pastime, and I am accused of having prompted Tom to assist in plundering the pockets of the carriage of all the buns and other eatables, which we demolished with great speed for fear of interruption. The next event I remember was a daft woman, who came and haunted Kirriemuir,[4] and often and often visited Kinnordy, swearing that she would not leave the country till she had one of 'the laird's bairns.' She attacked the nursery-maids one day most furiously, when they were out with us, who, frightened at her frantic questions, ran away. After several of these visits, which made a great impression on my imagination, they caught the poor creature, and locked her up in the stable, after which she never returned. I really cannot recall anything worth mentioning for nearly three years after. We lived at Bartley, and walked out among that beautiful wild forest scenery with the nurses, &c. My Grandmamma Lyell came from Scotland with her two daughters, and settled in Southampton, and their frequent visits to Bartley were agreeable incidents to the children, always with presents of toys, sweetmeats, &c. I was kept back nearly a year from going to school, in order to wait till Tom could go with me. Then, when I was seven and three-quarter years old, I was sent to Ringwood, to a Rev. R. S. Davies, about fifty boys there I suppose. What an event is this in a boy's life! It is completely a new world, and a rough one enough, if they have been humoured and petted.

It is a great amusement to me to recall scenes that seem so distant, and yet which are so vividly impressed upon my mind. Tom and I, and about three others, were the youngest in the school. One of these was a little fellow of the name of Montague, who must have been a complete 'Billy Bottom,' ready to undertake everything, and who undertook to direct us, teach us games, &c., and to whom we appealed for explanations. I went in the middle of a half year, and

[4] The neighbouring town in Forfarshire.

stayed, therefore, about ten weeks before the holidays. A few weeks after my arrival, a quarrel happened between the boys of the town, and ours. The former were familiarly called 'the blackguards,' and they termed us 'the Latin cats.' A challenge was carried, I know not from which party, to fight, accepted, day fixed, weapons (sticks) agreed upon, their size, and everything else. It was decided upon by a council of war that we five little ones were too small for soldiers, so we were to be left, but sworn to secrecy. Each one was called up, and told that if he blabbed, every bone of him should be broken. When the evening came, every one of the whole school marched and met the foe. They must have had a regular 'shindy,' as the Irishmen call it, for although the news of it spread in time for Davies and some of the tradesmen to rush in and separate them, a great number of heads were broken. All holidays were taken away for ten days, and extra tasks imposed, and a sermon read to them on their atrocious guilt. At that time smuggling was very active on the coast, and 'smugglers' was our favourite game. One party were the custom-house officers, the other were the contrabandists, with the kegs, &c. The first time I went out, not knowing what was to happen, I was so frightened by the surprise and hallooing, and row of the sham fight, when we were set upon from behind a hedge in a dark lane, that I verily trembled for my life.

At that time the expectation of a French invasion was general, and 'the volunteers' were incorporated. My father accepted a captaincy, and his corps were ordered to Ringwood, a pleasant event for us. Before my first return for the holidays, the rejoicings for the victory of Trafalgar were celebrated. There were bonfires on the summit of every hill round Ringwood, which had a grand effect at night: an illumination in the town, where almost every candle was blackened on the outside, in mourning for Nelson. The band of the volunteers played 'Rule Britannia' and 'Battle of the Nile,' while the people sang standing round a great bonfire in the market-place. The volunteers had a spite against the Mayor of Ringwood, because he would neither subscribe to their funds, nor let them exercise in a field of

his, so they threw squibs into his windows, and set fire to the drawing-room curtains, which were extinguished with difficulty. I remember participating perfectly in the mixed feeling of sorrow for the death of Nelson and triumph for the great victory. The Government, by way of making the volunteers on the alert, gave a sham alarm at Portsmouth and Southampton that the French were landed. I have since heard that this was a party ruse, to stir up the anti-Gallican feeling. The drums beat to arms. My father's troop turned out. My mother packed up a travelling trunk, to fly into the *interior*. It nearly cost my grandmother her life, she was near dead of fright.

The return to the liberty and luxuries of home, after roughing it at a boys' school, is of all things the most delightful, yet I always got rather weary of the idleness of home, and was almost glad to go back. Soon after my return to school, I saw two strange exhibitions. One was the chopping off of a duck's head, and the bird running for a short distance afterwards, which we thought good fun. The other was the killing of a calf, which I remember shocked me exceedingly. I think I see the animal stunned by the first blow now, the only execution I have ever seen of the kind. Little Montague, who let us into these good things, took us the same half year to see a corpse. A female relation (not an old person) of Mrs. Cleater, no less a personage than the accredited vendor of gingerbread and pies, &c., to the school, had died next door to the school. We saw the corpse laid out, covered with flowers; I recollect thinking it a pleasing sight. Montague knew that I and Tom were great pets of Rachel Davies, a girl of about thirteen, daughter of our reverend schoolmaster, so he bethought him to send me to Miss Rachel to ask, as a great favour of her father, to let us little ones, M. included, go to the funeral. This favour she obtained, and took us. Her father officiated. We thought ourselves in great luck, for a private soldier was buried the same day, and they fired over the grave. For weeks afterwards there was nothing but acting funerals, which superseded every game. Small graves were dug near the corner of the playground, or to whatever place the boys walked out, and some blocks of wood covered with a piece of

crape carried as coffins, and some going with their pocket-handkerchiefs to their eyes as mourners. I seem to see Montague now, with something like a gown on, lifting up his hands, and repeating, in exact mimicry of our old pedagogue, 'Ashes to ashes, and dust to dust.' When we buried soldiers, we made a grand row, to represent the musketry, and threw handfuls of dust for smoke.

Of all the dreaded penances which we had to undergo we thought going to church, sitting whole hours doing nothing, incomparably the worst; far more intolerable than lessons, in which I always had some mixture of pleasure. We took marbles in our pockets, to play at 'odd or even,' to relieve the tedium, and many other devices, for which we often got punished. I one day, as we returned from church, asked Montague 'what could be the meaning of "to beat down Satan under our feet"?' He was always ready with an answer, by which means he kept up his authority amongst us, and we gave implicit faith to his decisions and explanations. But this was nearly a poser. He replied, however, without hesitation: 'I cannot tell you, but I will show you by-and-by how to do it.' So he took our little squad to a shallow pool of water, and taking off his shoes and stockings, jumped about in it, splashing us all over, and then said he had been beating down Satan. I did not presume to doubt his interpretation, but for years afterwards thought it so odd that he had not jumped on a piece of satin, instead of water, which was only soft like satin.

I have not reached the beginning of my tenth year, and have not left Ringwood. The last half-year I was there, a set of strolling players set up a stage in a barn, and persuaded our master to let the whole school attend. They acted 'Hamlet.' I had never read a play, nor had any notion of such a thing before, yet I entered into it so much that the impression remained very vivid, and when, years afterwards, I read the play, I thought the effect much heightened from my former recollection. In almost every other instance when I have read Shakspere first, I have found the acting fall short of my conceptions of the play from reading; besides the natural indignation one feels for the liberties they take in altering the text, which I never could endure even as a

schoolboy. I remember being puzzled at the play within play in 'Hamlet,' but my delight in the Ghost scene was very great. I should like much to know what was the degree of mediocrity of the poor itinerants, for I question whether I have ever thought any acting since comparable to them.

It was now decided that Tom and I should leave Mr. Davies's, who was no great scholar, and whose set of boys was of a very mixed kind, and not so select as my father thought he might get at Salisbury—at Dr. Radcliffe's. This Dr. Radcliffe was a good man, and kept a school of about fifty boys, and all of the very best families in Wilts, Dorset, and part of Hants. We had the Portmans, Windhams, Beresfords (Irish), Beckfords, Preston, &c. The Doctor was a good Oxonian classical scholar, and had two good ushers. We had a long holiday at home between the schools.

Bartley belonged to a Major Gilbert, and consisted of eighty English acres, seventy of which was laid down in grass, and produced hay, which was celebrated as the best in the county for the hunters—for Lyndhurst was only two miles off where the New Forest hounds were kept. The hay harvest, therefore, was a great concern at Bartley, and when we returned home for each summer holiday the mowing was always just beginning. We (Tom and I) used to attend the mowers all day, and learnt to mow a little, and used to tumble about with Marianne and Fanny in the haycocks, and ride in the loaded waggons to the haystack. It lasted the greater part of our five or six weeks' holidays, as part of the land was always three weeks later in being cut. I have always since thought haymaking the most delightful of sights. We always had our small rakes and forks, and used to try how much we could glean after the waggon. As the whole of this grass land was unenclosed, and surrounded the house, it made a good-sized park, and was full of fine old oaks, some of which the Major cut down whenever he wanted a few hundred pounds, for which I always owed him a grudge, for I knew every tree, great and small, and used to miss them as you might a piece of old furniture in a room. To every clump and single tree in the park I gave a name. One was 'Ringwood,' another 'Salisbury,' or 'London,' or

'Paris,' &c. Single trees were named after flowers, an odd fancy: thus one was called 'Geranium.' These names were afterwards adopted by the rest of the young ones. Although I never forgave the Major for cutting the large oaks, yet there was nothing I was so fond of as seeing trees felled.

We were now allowed to roam about a good deal by ourselves, and I always contrived to learn where the trees were to be cut within reach of a walk, which was very frequent, for the demand for the navy was then most pressing; and besides the thousands of splendid oaks then cut near Lyndhurst, a great number of beech trees were also consumed, for every house has a right to a certain share of firewood, by old custom, from the king's forests. I have been reading lately that the Government surveyors found that forty acres of the best soil for oaks were required to build one seventy-four gun-ship, the oak being a century old, and a fair proportion of young trees being left. In other words, that forty acres of good oak soil would produce a seventy-four per century. The 'Agricultural Journal' adds: 'In all Scotland there is not now ash timber enough to build two large men of war.' You may suppose that when such numbers of frigates and so many men of war were built at the time I allude to, at Portsmouth, which was so near, and when the price of timber was at its height, how annually, at 'one fell swoop,' large spaces were denuded of their noblest trees. In order that a large tree might not injure younger wood in its fall, much skill was required in so driving in wedges, after the tree was sawed through near the root, as to direct its weight to some clear space. The last wedge being driven in, the tree was supported by its roots, and when all were severed but one strong root, and this half cut through, the axe used to be given to us boys, and we had the pride, at one blow, of finishing the work. The tree at first moved slowly, then fell with great rapidity, and with a magnificent crash as the boughs reached the ground.

I had only reached my tenth year when I went to Salisbury, sixteen miles from home, to Dr. Radcliffe's—a school in the middle of a large town, whereas Ringwood school was in the suburbs of a small one. In this respect we thought the change for the worse. Instead of a large meadow for a

playground, near a river, where we could bathe, and where we were in the country the moment we walked out, which we enjoyed at Davies's, we had now a small yard surrounded by walls, and only walked out twice or three times a week, when it did not rain, and were obliged to keep in ranks along the endless streets and dusty roads of the suburbs of a city. It seemed a kind of prison by comparison, especially to me, accustomed to liberty in such a wild place as the New Forest. Our favourite walk on holidays was to Old Sarum, the celebrated rotten borough where one alehouse, with its tea-gardens attached, sends two members to Parliament, and which Lord Caledon bought no great time since, at its full price, little thinking of the evil day which approached. Sir Rufane Donkin remarked to me that the fact of Alexander Baring having given 42,000*l.* for a borough within a year of Schedule A, had destroyed his (Sir R.'s) confidence in *the funds*, for in this case too, he says, shrewd merchants may equally miscalculate the approaching era of the *sponge*. But I must not run into such digressions. This Old Sarum is a singular isolated chalk-hill, on the summit of which is a splendid old camp, with a deep triple trench. I have seen many, but not one where the moats are so deep, and the slope of the high banks so rapid. We used to heap piles of large chalk flints on the opposite ridges, and set them running to the bottom, where they broke on meeting and dashing against each other, as they descended from the opposite sides. Then we examined to see which had crystals of calcedony in the middle, or of sparkling quartz. Near the centre of the flat space enclosed within the mounds and trenches was a deep long subterranean tunnel, said to have been used by the garrison to get water from a river in the plain below. But whatever its former use, it was to us a great source of fun. According to established custom, I and some other new comers were taken to the mouth of a subterranean passage, in which the air was very cold. While we stood looking down and wondering, all sorts of tales were told of its enormous depth, and how it grew steeper far down, and ended in a pool of water, &c. Then some of the initiated got behind us, and knocked off all our hats, which began to roll down, and were soon out of sight. After a great laugh at our

expense, and when we were in dismay at the thoughts of parading the streets of Sarum in hatless plight, a guide was appointed, whose duty it was to take all of us down in search of our lost property. We went down many hundred yards, standing upright, then were obliged to stoop. Here I found my hat, but the others had gone farther, and their owners were obliged to crawl on, upon all fours, with their guide. They soon came to a large chamber, very dark, where, after groping about in the dark, they found their hats, greatly improved, of course, as was mine, by knocking about upon dripping chalk and hard flints in their descent. The passage went on, but how far, I know not.

At Ringwood I think my studies were confined to English, to writing and reading, and getting things by heart. At Sarum I began the Latin grammar, which, disagreeable as it is, is considered by most schoolboys as a piece of promotion when they first begin it. There was nothing at Radcliffe's for exciting the emulation of the boys, and as I had an aversion to labour, which nothing but such a stimulus could overcome, I learnt but little during the two years I was at this school.

Bartley appears still to me, and all of us, more a home than even this (Kinnordy). It is the home of our recollections, at least, and it was the place where as schoolboys Tom and I spent our holidays. Had I spent them here, I am sure I should have had a delight in Kinnordy which I shall never have now,—much as I like it. All the trees in the park were oaks, and in the surrounding hedge and ditch were oaks, beech, and a few clumps of fir. Near part of a group which I named 'London' there was an old brick kiln, overgrown with briars, which I may mention again. A clump of trees on the slope of the hill was 'Romsey,' and a single tree in front of the right wing of our house was always styled 'The Umbrella,' from its shape. It was a fine oak, spreading equally on any side.

To return to Salisbury, we called our pedagogue Dr. Radcliffe 'Bluebeard,' because he had then his *third* wife. She died soon after I left, and he married a fourth, who I believe is now alive. He was a diligent teacher and fair scholar, and had a very rare merit, that of impartiality, which many

of his ushers had not. One of these, Monsieur Borelle, the French master, was much disliked for favouritism. He was an emigrant, had been in the army, and being very poor, Dr. R. gave him leave to sleep in the house. His room was within one in which I and eight others slept. One night, when we were very angry with him for having *spatted* us all round with a ruler, for a noise in the schoolroom, which only *one* had made, and no one would confess, we determined to be revenged. We balanced a great weight of heavy volumes on the top of the door, so that no one could open it without their falling on his head. He was caught like a mouse in a trap, and threw a book in a rage at each boy's head, as they lay shamming sound sleep. Another stratagem of mine and young Prescott (son of Sir G. P.) was to tie a string across the room from the legs of two beds, so as to trip him up: from this string others branched off, the ends of which were fixed to the great toes of two sound sleepers, so that when Monsieur drew the lines, they woke, making a great outcry. At last we wearied him out, and he went and slept elsewhere. I conclude that there were far too many hours allotted to sleep at this school, for at all others we were glad to sleep after the labours of the day, and got punished for late rising in the morning, and being too late for roll-call. Here, on the contrary, a great many of our best sports were at night, particularly one, which, as very unique, and one which lasted all the time I was there, I must describe. It consisted of fighting, either in single combat, or whole rooms against others, with *bolsters*. These were shaken until all the contents were at one end, and then they were kept there by a girth of string or stockings. This made a formidable weapon, the empty end being the handle, and the ball at the other would hit a good blow, or coil round a fellow's leg, and by a jerk pull him up so that he fell backwards. The rules of our military code for the 'bolster-fight,' which were observed with the rigour which boys always introduce into their sports, were as follows. No one could put on any clothes, save chemise and nightcap; no one might return kicks or fistycuffs for blows with a bolster; no more than two rooms which were contiguous, or leading into the others, could join forces either

for attack or defence. The invading party were always to station a watch at the head of the stairs, to give notice of the approach of 'Bluebeard,' for he was particularly severe against this warfare, though he never succeeded in putting it down. He used to come up with a cane, which, as none were clothed, took dire effect on those caught out of bed. He had a fortunate twist in his left foot, which made his step recognisable at a distance, and his shoe to creak loudly. This offence was high treason, not only because it led to broken heads and made a horrible row in the night, but because Mrs. Radcliffe found that it made her *bolsters* wear out most rapidly.

I shall never forget the confusion when the scout gave notice that the enemy was approaching. The invaders ran most risk, as they had to make their way back to their room, but in compensation they were able, when they surprised a chamber of sleepers, to give them all a good blow round before they began to fight. If some could not make good their retreat, I have known them get up the sooty chimney, and when the Doctor was in the inner of the two rooms, descend and get to their bed before he came back; or if they were so unlucky as to be in the inner room of the two invaded, they could only conceal themselves, and their friends at home would sometimes get them off by putting a bolster into their bed with a nightcap on, to be mistaken for them.

Among other amusements, was keeping field mice in boxes, concealed under our beds. These were dug up in the fields, with their stock of nuts and grain, a favourite sport. The young mice were carefully educated in the use of a small musket, for they were very docile, and would hold the small piece of wood between their fore feet, and shoulder, ground, and present arms, at word of command, and go through a whole drill. You may suppose that by this odd feat being taught the little animals, that we were at that time in the habit of seeing a drill. In fact a sergeant was employed twice a week to drill us, and we had all guns with tin barrels and locks, a strange fancy rather, but as there were volunteer corps everywhere, I suppose Dr. R. had his head full of

the chances of invasion. The exercise, however, of the drill, was very proper at a school.

I had the measles at this school, my first year I think, very severely. I was in a high fever, I thought myself for two days going round a number of wheels in all directions, one of which transferred me to another, until I was giddy; and I thought there were thousands of others going round in the same manner, which appeared whichever way I turned. I had long a fear of going to sleep afterwards, lest this, which, however, was a *waking* dream, should return.

At this time, in my eleventh year, 1808, my Aunt Ann married Captain Heathcote, R.N. This connection brought us into still greater intimacy with Mr. Heathcote, then M.P. for Hants, afterwards Sir Thos. H., and during our holidays Tom and I paid some pleasant visits to Embley. My Grandmamma Lyell had till now resided at Southampton with her two daughters, the eldest of whom, Mary, still lived with her there. They came over once to the music meeting at Sarum, a triennial fête, and took Tom and me to part of it. Soon after this I was ill, and Dr. Fowler of Sarum rather alarmed my mother about the air of Sarum being bad for me, and that I seemed falling into a consumption, and that my lungs were affected. I thought it all stuff at the time, though certainly I had some complaint on my lungs, which I have not had since; but as I did not like Sarum, I did not try to make light of it, and was taken home for three months. As they were afraid to overtask me, I began to get annoyed with *ennui*, which did not improve my health, for I was always most exceedingly miserable if unemployed, though I had an excessive aversion to work unless forced to it. It happened that a little before this time my father had for a short time exchanged botany for entomology, a fit which only lasted just long enough to induce him to purchase some books on the latter subject, after which he threw it up, principally I believe from a dislike to kill the insects. I did not like this *department* of the subject either, but soon satisfied myself that their feelings must somewhat resemble that of plants, that one part can live long without the other, that they will eat after many of their limbs are cut off, fight when

pins are stuck through them, fly away when all their insides are emptied out, and other signs which imply a kind of vitality too remote from that of the higher warm-blooded animals to awaken any feeling of disgust in one who studies them much, at the idea of giving them pain, by the length of time which it takes to slay them, at least, unless the operation be unskilfully performed. Collecting insects was just the sort of desultory occupation which suited me at that time, as it gave sufficient employment to my mind and body, was full of variety, and to see a store continually increasing, gratified what in the cant phrase of the phrenologist is termed the 'accumulative propensity.' I soon began to know what was rare, and to appreciate specimens by this test. In the evenings I used to look over 'Donovan's Insects,' a work in which a great number of the British species are well given in coloured plates, but which has no scientific merit. This was a royal road at arriving at the names, and required no study, but mere looking at pictures. At first I confined my attention to the Lepidoptera (butterflies, moths, &c.), as the most beautiful, but soon became fond of watching the singular habits of the aquatic insects, and used to sit whole mornings by a pond, feeding them with flies, and catching them if I could.

I had no companion to share this hobby with me, no one to encourage me in following it up, yet my love for it continued always to increase, and it afforded a most varied source of amusement. I was chiefly attracted by the beauty of the Lepidopterous tribe; in common parlance, by the butterflies, moths, hawk-moths (sphinxes), besides the procuring the chrysalis and seeing its transformation; and the feeding and breeding of caterpillars was another reason for preferring this numerous and showy class. I soon, however, learnt to prefer the rare to the brilliant species, and was not long in discovering, by the comparison of one season with another, that each species had its peculiar time for appearing, some twice, some once only in the year, some by day, some in the evening, and others at distant hours of the night.

The only other insects that engaged in the least my attention at that time were the aquatic. I was greatly surprised to find every pond tenanted by water-beetles of different sizes

and shapes, and to observe them row themselves along by the broad row of bristles attached to their legs. I threw flies and moths into the water and observed them rise, and learnt their relative strength, seeing some species relinquish the booty on the appearance of others. The long spider-like flies which run on the surface, the glimmer chafers which thread the surface, in what we called a figure-of-eight movement, the beetles which swim on their backs, and many others, such as the red tick, used to be caught and brought in a basin into my bedroom, and there kept, to the annoyance of the housemaids when the water was none of the sweetest; and then the whole were fed with window-flies, until some died, and others took wing in the night, and flew back to their native waters. I passed nearly the whole day alone fishing for this small fry in some deserted gravel pit, or often in a great pond called the brick-kiln, just by the fir-trees called by us 'London.' This sport could be pursued even in winter, and often I have found the large water-beetles frozen in the ice which covered our ponds, and have brought home blocks and melted them out. By this same brick-kiln (out of which all the brick clay of which the house was built had been taken) there were a great quantity of brambles, the flowers of which in summer were usually ornamented by numbers of the most beautiful and rarest of the English butterflies. Among these, three varieties of Frittilary and the black Admiral (Camilla) were conspicuous. I was very ill supplied with instruments, both for taking and preserving my prey, and many insects of real value to the entomologist, as I afterwards discovered, were mutilated by being knocked down by my hats, and then pressed between the leaves of a white paper album. As my hats shared often in the mutilation, I received sundry admonitions on that score, till at last Miss Newlands, the governess, knit a small string net, a very poor substitute for the gauze apparatus which would have equally secured the flies, and kept them there when once in. The larger ones, however, could not escape from these toils, and the number caught was soon greater than I had the patience to preserve. After a time my Aunt Mary gave me a piece of furniture, henceforth called 'Charles's Secretary,' an heirloom, which was not wanted in their new lodging when

they quitted that which my Grandmamma Lyell and her unmarried daughter had previously lived in in Southampton.

This valuable acquisition was immediately turned into a cabinet for insects, which, for want of a lining of cork in the drawers, were impaled on the softish wood in the bottom of each, which was nevertheless hard enough to turn the pins sometimes. I still possess this piece of mahogany, and although only fitted for a bedroom, I still look upon it as a favourite, and used to have it in my sitting-room in the Temple. Transfixing these insects upon the soft wood of these drawers was a great step beyond pressing them between paper, and some of the varieties thus preserved were afterwards useful to Curtis the entomologist. My father's head livery servant, John Devinish, who had been employed to botanise, and showed some skill in discovering some of the rare species of that minute tribe the Jungermanniæ (allied to the mosses), was the only associate I ever remember to have obtained in my rambles through the Forest. With him I formed as strict an alliance as his scanty leisure permitted, but any sympathy was valuable, any one sufficiently familiar with the *commoner* species to be capable of appreciating a great treasure when carried to him on some triumphant occasion. Instead of sympathy, I received from almost every one else beyond my home, either ridicule, or hints that the pursuits of other boys were more manly. Whether did I fancy that insects had no feeling? what could be the use of them? The contemptuous appellation of 'butterfly-hunting' applied to my favourite employment always nettled me, yet since one class of insects was sought to the exclusion of almost every other, a naturalist even might have found some point in such a disparaging designation of the hobby. It must be confessed, too, that the organ of acquisitiveness, of which craniologists talk, was more bent on the miserly delight of amassing treasure, than in using it, for it was less for information than the love of possessing the specimens that they were accumulated. Of their history I knew but little, and still less of their structure, yet I knew most accurately to distinguish several hundred species, some very minute; and still retained a very perfect recollection of nearly all, and could select the English butterflies and moths out of a foreign collection,

and without the aid of books, gave names to certain tribes, such as the 'fold-up-moths,' 'the yellow-underwings,' &c. &c., which I afterwards found were natural genera or families, and my rule of thumb classification had thrown them into natural groups. In the course of each holiday, for three or four years successively, I fell back into my old haunts in the woods, and became so keen before my return to school, that I could seldom resist the temptation of employing my leisure hours there in the same way. I could not see a rare moth without catching it, especially if not exposed to be laughed at by any witnesses of such a queer fancy. When taken, they were put between the leaves of my dictionary, as the only book not taken up to lessons. When I looked out a word, I often found the two pages firmly glued together by some moth, the contents of whose body had been squeezed out between the leaves. The disrepute in which my hobby was held had a considerable effect on my character, for I was very sensitive of the good opinion of others, and therefore followed it up almost by stealth; so that although I never confessed to myself that I was wrong, but always reasoned myself into a belief that the generality of people were too stupid to comprehend the interest of such pursuits, yet I got too much in the habit of avoiding being seen, as if I was ashamed of what I did.

Among the things which supported me in my secret estimation of entomology, was the number of expensive books on the subject which I found in my father's library. Many of these were full of plates, but these did not weigh so much with me as those written in Latin, and full of dry descriptions and hard terms, for it was evidence of the learned and studious sages who had devoted their time to it. But with the exception of a few scraps of Linnæus, I never troubled any one of these learned writers, but whenever I got a new thing, turned over all the plates, till I saw whether I could find the name by that royal road to knowledge. If found, the first inquiry was, whether it was rare.

I have now reached the eventful period when I was about to leave Salisbury, and go to a new and last school. There was an interregnum of near half a year, in which Tom and I were taught by my father at home. I believe we got on

pretty well. We read at that time Virgil's 'Eclogues,' &c., and a French master came out twice a week. At length it was decided that we should go to Winchester, but it was found that our names should have been down on the College lists for two years, to give us a chance of entry. So another school, as a sort of preparation I believe, was decided upon, kept by Dr. Bayley (once a master at Winchester, and an Oxonian), who had about seventy boys, in a school of ancient foundation, at the old (rotten) borough of Midhurst in Sussex, a beautiful spot just opposite the old park of the Castle of Cowdray, which belonged to the Montague family, the title of which is now extinct, and which belongs to Poyntz, who married the daughter and heiress. Dr. Bayley had married a Goodenough, one of the Bishop of Hereford's first cousins. He had been long in good society at college, and then at Winchester, and it was natural perhaps enough that he should feel the change to a small provincial place, where there was no society but a few tradespeople, &c. The school into which I was now ushered was a very different world from either of the former. From the age and number of the boys, and the system adopted, it had all the character of one of our great public schools. I was now past the age of twelve, and no longer reckoned one of the little boys. Whatever some may say or sing of the happy recollections of their school days, I believe the generality, if they told the truth, would not like to have them over again, or would consider them as less happy than those which follow. I felt for the first time that I had to fight my own way in a rough world, and must depend entirely on my own resources.

You have never heard, perhaps, how much the different boys struggle for power, and how exactly each learns at last to know who is his master, a supremacy which depends partly on spirit, or as they term it *pluck*, and in part on physical strength. There are always some pugnacious fellows who rather delight in affrays, and in setting others on, and are the dread of the weak quiet-spirited youngsters. They are often bullies, who are afraid of many of their own age and strength, and knock under to them, but who torment the quiet souls, and are hated as tyrants by the weaker

and younger in the school. There are some from kindly feeling, but many more who from a love of affording protection, and feeling their own consequence by shielding others, take a certain number under their care. You often hear some luckless wight who has been struck, exclaim, 'I'll tell C. of you if you hit me again.' As to telling *the master*, that is an appeal against the law whatever cruelty may prevail, and finds sympathy with none of the boys. One of the oldest boys in the school, Deacon Senior (for there were three of them, Senior, Secundus, and Junior), voluntarily took me under his charge for nearly all the first half year, out of pure kindness, and then told me I was old enough, and had been there long enough, to shift for myself. No sooner was it known that I could not resort to a patron any longer, than I began to be cuffed about and persecuted. Almost every boy has to fight one battle before he gains a position—before it is settled who is to be afraid of him, and of whom he has to be in fear. It required a good deal to work me up to the point to defend my independence, although I could not brook being put upon by my juniors, and about the middle of the second half year I was set down by many as incapable of resistance. At last I saw that not to resent and to fight, was a sure way of suffering more than any battle could entail, yet this was the result of reasoning, and I was never ready to retort immediately. One day a vulgar low sort of a boy, of the name of Tilt, had got into a quarrel with me, and a good many of the complimentary epithets so common among schoolboys, such as ass, fool, raff, and finally coward, were exchanged, upon which he hit me a blow which knocked me to the ground, and gave me a severe bruise on my head. As Tilt was a full year younger and half a head shorter than me (though stronger built), I was annoyed beyond measure by this ignominious occurrence, and after some hours mustered up courage to declare to some boys who came to ask me if it was true that T. had knocked me down, that 'I should like to see him try it again.' Immediately the report was spread that I was ready to fight. The delight which the intelligence of an impending battle occasions is always great, and numbers came to pat me on the back, to offer to be my 'bottle-holder,' to

advise me to have 'two minute rounds,' &c., and every expedient for prolonging the diversion. One was appointed to hold the watch and proclaim when the rounds were to begin. It was decided that instead of two, only one minute should be allowed between each bout, so if one was knocked down, and was not up again and ready in one minute (the other calling on him to fight), the affair was over, and the one who declined coming to the scratch was to 'receive the cowardly blow,' a gentle tap, followed by a shout of the friends of the victor, and then sometimes, but rarely, by a shaking of the hands of the two combatants. This fight lasted two days, five or six hours each day, for there was no half holiday, and we were pretty equal, Tilt having learned to box, and so being nearly equal, though weaker than me. Both his eyes were black and his side much hurt, and his head swollen for a week after. I was, I believe, very much hurt, but my wounds were not in the face; and though I ought to have been put to bed, as he was, my friends advised me to put a good face on it, and pretend not to be hurt, 'as it would make others twice as much afraid of me.' I suffered severely from sustaining this character for eight days. I recollect the pain at this moment—every bone ached, and I was black and blue all over my body, and so stiff, that when I walked up 'to hills' on half holiday, I was obliged to get the arm of a friend. After an affair of this kind, there is a discussion amongst the different boys of the same age and standing whether such and such a one ought to be afraid of the conqueror. Every disparaging circumstance is brought forward, and as I was a year older than Tilt, it was said that I ought to be ashamed of having taken two days to do him up; 'besides, Lyell's more damaged than he pretends to be, his is a skin that don't show it so much as Tilt's,' &c. In fact I gained less than most would have done from so severe a combat, yet every boy who was afraid of Tilt had from that day of course great respect for me and my *fist*; and this saved me from much molestation, and I felt I had gained a great point.

A short time after this, a most desperate battle took place between Carter (one of the cousins of the present M.P.), a Portsmouth boy, and Norris, two of the biggest in the

school in the second class. It lasted three days, and was a most savage concern. The pluck with which they fought on, after both had grown pale with the blood lost from the nose, and black with bruises, and when each could scarce totter on his legs from weakness, was a sight that I recollect thinking barbarous and brutal; but the eager enjoyment and admiration of the school at their *pluck* was surprising. You cannot imagine the extent to which the stronger and more spirited, domineer over the milder and more timid. You will see on a cold day, when a crowd of little boys are round the fire shivering, three larger or more powerful walk up, and, without any order or hint, the crowd steals off, and the three monopolise the warmth for hours, and will let none but themselves toast or boil or bake on the fire. There is often, too, a sort of tribute paid by the weaker to propitiate these majestic powers. They receive all kinds of presents, in order to make them less free with their cuffs and exactions. For though fagging was not allowed, as in some public schools, yet there is always much hard service exacted by the older and stronger from their inferiors in age and prowess. Some boys quite sink under this roughing, but in general they become more manly and hardier. If they have come from a comfortable home, have been petted and spoiled to some degree, are sensitive of insult and hard usage, and yet not possessing force of character enough and active courage to fight their way, they must go through a most painful ordeal before they feel themselves at all comfortable, especially when about the middle of the school. The recollection of it makes me bless my stars I have not to go through it again.

There were about seven classes, two of which were inferior to the one I was placed in, and at the bottom of which I found myself. Every year some from the top of each class were draughted into the class above—not those who happened to be at the top when the half year was over, but, by a much more judicious arrangement, those who during the five months had been oftenest at the top or near it. I must describe to you how this was ascertained. The 'Classicus Paper,' an invention adopted I believe from time immemorial at Winchester, and some other of our great public schools,

was kept by each class, in which document each boy's place at the end of the day was noted down. Thus, suppose there were eight boys in the class. Their names would be arranged according to the number which they had got the week before, when Forbes being least was Classicus, and had the fag of keeping the Classicus Paper. But as he obtained the mark of 13 during that week, and topped Lyell Senior, the last-mentioned dunce would take his place, and be Classicus for the ensuing week. The great satisfaction with which the said paper is handed over to another to keep, may be con-

Feb. 2. A.D. 1811.	Blake	Thresher	Bailey Tertius	Deacon Junior	Dunbar	Ramsay	Lyell Sen.	Forbes
Monday . .	8	7	6	5	4	3	2	1
Tuesday . .	7	8	5	6	3	4	1	2
Wednesday .	6	5	8	7	4	1	2	3
Thursday . .	8	6	5	7	1	4	3	2
Friday . . .	5	7	6	3	8	2	1	4
Saturday . .	8	7	6	5	4	3	2	1
Total . .	42	40	36	33	24	17	11	13

ceived, for it is considered as a place of some reproach. Every boy is put on to translate a passage in his turn, and as often as he fails, the word is passed on to the next below: if he knows it he takes the other's place. In this manner the attention of all is kept alive, for the boys at the top of the class are liable immediately to lose ground unless they are constantly attending to what those at the bottom are doing; for when the last cannot answer to a question passed down, it goes over to the first boy at the top, and if he is absent, he loses a place immediately, however easy the query.

I believe this and the Classicus Paper to be an admirable contrivance for exciting a constant spirit of emulation, for checking favouritism in the teacher, for ascertaining the relative strength of different boys, knowing how to promote them into other classes, fixing their attention, &c. At the end of the half year, all the totals being added together, the boy who had the highest number received a prize, and three or four of the first or more were raised into the class above. The competition was greatly increased, as boys rose to the higher classes, because those of the first had many valuable privileges. They were called 'The Seniors,' and constituted the magistracy, being empowered by the head master to keep the rest in order, to report on all boys found 'out of bounds' or guilty of any other delinquency. Of course the entrusting such powers to young boys of sixteen to eighteen was liable to some abuse occasionally, yet it works well, and the effect upon the whole is, that much of the tyranny that would otherwise prevail, of mere physical force and bold daring dispositions over the meek and tenderer bodies, was kept down by the supremacy of responsible magistrates, raised to their station by talent, and usually younger than *some* of the idle bullying dunces in the inferior classes. To strike a 'Senior' is viewed in the same light by the head master as for a junior officer in the army or navy to strike or challenge a senior, and such an act of insubordination was quite unknown. Besides, there were almost always one or two in the first class stronger than any other in the school, who made a point of enforcing the most complete respect to the weakest in the 'magistracy' from the greatest of the junior boys. We used to see with great delight some youths who had been kept under by certain dreaded characters, suddenly put over their heads by being promoted to the first class. The Senior might retaliate then upon his old enemy in a legitimate way, by being very strict in looking after him, and reporting any breach of the law, which might have been winked at in a less obnoxious individual.

My ambition during the second half year was excited by finding myself rising near the top of a class of fifteen boys, in which I was; and when miserable, as I often was, with the kicks and cuffs I received, I got into a useful habit of

thinking myself happy when I got a high number in the class-paper. So great an effect had this on me, that if I was lower than usual, and we failed to get on certain occasions a half holiday on Friday (an extra treat given now and then from fine weather and other occasions), I used immediately to comfort myself with the idea that I should probably get a higher mark. On the other hand, if unusually high up, my anxiety was great to get the holiday, as then I was secure of that number. By this feeling, much of my natural antipathy to work, and extreme absence of mind, was conquered in a great measure, and I acquired habits of attention, which, however, were very painful to me, and only sustained when I had an object in view.

At the end of the first year arrived the anniversary, or what was called 'the speaking,' when certain boys recited verses written by themselves, those in the first two classes; and the rest different Greek, Latin, and English passages. The rehearsal first began, at which every boy had to exhibit, and then ten were selected to perform before the public. I obtained one of the places for reciting English, and was accordingly gifted with a prize, Milton's 'Paradise Lost,' of which I was very proud. Every year afterwards I received invariably a prize for speaking, until high enough to carry off the prizes for Latin and English original composition. My inventive talents were not quick, but to have any, is so rare a qualification, that it is sure to obtain a boy at our great schools (and afterwards as an author) some distinction. I had a livelier sense than most of the boys of the beauty of English poetry, Milton, Thomson, and Gray being my favourites; and even Virgil and Ovid gave me some real pleasure, and I knew the most poetic passages in them. I was much taken with Scott's 'Lady of the Lake' on holidays, when I had risen to the second class, and presumed, when the prize was given on 'Local Attachment' in English verse (it being an understood thing that the metre was to be the usual ten-syllabic rhyme), to venture on writing it in the versification of Scott's 'Lady of the Lake.' The verses were the only ones out of the first class which had any originality in them, or poetry, so the Doctor was puzzled what to do. The innovation was a bold one: my excuse was that he had not given out a

precise metre; on which he determined that this case was not to serve as a precedent, that in future the classical English metre was to be adopted, but mine was to have the prize, being eight-syllabic and irregular, and not in couplets.

When in the second class, I wrote a Latin copy of verses (a weekly exercise required of all) on the fight between the land-rats and the water-rats, suggested by reading Homer's battle of the frogs and mice—a mock-heroic. Dr. Bayley had just drained a pond much infested by water-rats, which was on one side of our playground, and they used to forage on not only our cakes and bread and cheese in the night, but literally on our clothes and books. I am sure that from the date of this early achievement to the present hour I have never thought of this copy of verses; but I can recall with pleasure the incident, and it convinces me that I must very early have felt a pleasure not usual among boys of about sixteen in exerting my inventive powers voluntarily. The plot was begun with a consultation of water-rats, to each of whom altisonant Greek names were given, after the plan of Homer—cake-stealer, gin-dreader, book-eater, ditch-lover, &c. The king began by describing a dream in which the water-prophet covered with slimy reeds appeared to him, foretelling that the delicious expanse of sweet-scented mud would soon dry up, and foreboding woes. Part of the warning was copied or paraphrased from the Sybil's song to the Trojans in the 'Æneid' of what should happen when they reached Italy. The dream and warning, taken, I suppose, from Agamemnon's to the Grecian chiefs, being communicated, the others entered into the debate what they should do, and it was agreed that, as the fates had decreed the drying up of the waters, they should migrate to a neighbouring sewer, and should destroy the house-rats, who consumed so much provender in the schoolroom, and who had usurped their rights. One passage, in which a chief was described as a great map-eater, and having at one meal consumed Africa, Europe, Asia, America, and the Ocean, was admired as a good specimen of pompous description of mighty deeds, on the first entrance of a hero in an epic poem. The verses ran on to thirty-eight, and when done, there was great discussion whether I should dare show up such a thing. It

was thought, however, a wondrous feat, till the second master, Mr. Ayling, a youth of nineteen, who heard of it, said, 'I dare say it's all nonsense and bad Latin.' I was requested, in vindication, to let him see it before it went up to Dr. Bayley. To justify his own anticipation, he cut it up as much as he could, pointing out all the grammatical errors and one false quantity. Though he thus made many think light of it, and checked my growing vanity not a little, it of course had the effect of my correcting the lines, and rewriting a copy. Dr. Bayley, when he saw it, was much surprised at the correctness of the Latin, and struck, more than he chose to admit to us, with the invention displayed in the whole thing. He told the class that it was such good Latin that I deserved great credit, but he did not wish them or me to send him up more mock-heroics.

From this time I took it into my head that I should one day do great things in a literary way, but my ambition was quenched afterwards, by failing in carrying off any prize at Oxford.

But I must not digress, but return to my school-days again. Indeed, I have already been running on to near the highest class in the school, whereas I must return to the long toilsome ascent of the ladder, and to my second half year, when I was just fighting my way among the boys, and getting out of the fifth into the fourth class by high numbers in the Classicus Paper. It was the custom of Dr. Bayley to have the highest classes chiefly under his immediate care, but once in six weeks each of the others came before him in review. This much dreaded inspection was intended not only for the boys, but also for the under-masters, and when the great Doctor called out in a thundering voice, 'This class is disgracefully backward,' not only every boy in it quaked with fear, but the under-masters, if they had been idle, participated in the feeling of reproach. Two of these were university men—Ayling and Belin, the latter the son of a French *émigré*, and who had been brought up at Winchester, and I believe New College, Oxford. Although I abhorred these reviews as much as any one, yet when they were over I had usually the comfort of feeling I had gained in the Classicus Paper. The reason of this was that my

father used during every holiday to require me to read with him, a certain part of every day, on the books we were going to work at the half year following. In this exercise he always went out of the beaten path, and instead of confining me to the mere translation of the Latin and Greek, used to teach me the geography and mythology, &c. Now Dr. Bayley usually finished each day by a few questions quite out of the ordinary line, and I often astonished the class by answering them. Well do I recollect a day when I was within two of the bottom of a class of about fifteen, the first boy being asked what the Ægean Sea was now called? It was passed all the way down, every one staring with astonishment, and when I answered, 'The Grecian Archipelago,' and was ordered to take all their places, I sat down, feeling quite dizzy at the sudden elevation. From this height I should have been at once precipitated to my former place if I had been 'put on' afterwards, but it was the end of the lesson, and we were dismissed, I scoring fifteen, a number nearly equalling an ordinary week's work.

About the end of the first year a spirit of gambling began in the school, which reached its height about the middle of the succeeding half year. First it was draughts, a penny a game; then some got cards, but these being against law, the Seniors suppressed them. The draughts, however, and betting on the game, and on other players, continued, and when all our money was gone, we gambled like savages for our food, and would have played for our clothes, if they had been part of the disposable goods belonging to us. It was common to hear this challenge, 'I'll bet you my Wednesday's top slice, against your Friday's bottom slice, that I beat you most games out of five.' Now this you must know was wagering half a breakfast against another moiety, but as the two slices were of unequal value, the top, as we called it, of the round of the loaf being less than the bottom half, the better player who wished to tempt his antagonist by offering him odds, either staked his bottom slice against the other's top slice, or to-morrow's against one not to be paid for several days hence. Schoolboys generally are as ravenous as wolves, and always almost fancy they have too little to eat. They take much exercise, are usually

in fine vigorous health, not over-fed, as at home, and ready to devour the allotted portion. You may imagine, therefore, the misery of the famished gambler, who was obliged, when the sound of the breakfast bell rang, to go and seat himself in the midst of the others, who were eating their bread and butter, and drinking each a small basin of warm milk and water, without having himself more than half, and often none, of his ration. Payment was always rigorously exacted and made, but some were able to borrow when in distress, though usually on usurious interest. 'If you'll lend me half a slice to-day, I'll pay you a whole one on Saturday.' Some of those who had lost all their breakfasts for several mornings running, of whom I was occasionally one, got into a habit of taking out one of the iron bars of the window, and getting into the breakfast-room, or stealing in when the door was left open, while John Budd, the purveyor, was gone out to get the milk, having laid out the bread and butter. When in, they clipped small bits off the slices of the larger rounds, which would best bear it, and picked the butter out of all the holes in the spread slices. They were caught more than once at this petty larceny, and made severe examples of by the other boys, without the interference of judge or jury. I was cunning enough to escape one of these summary punishments, but was often in a dreadful fright; and once, when I heard Budd approach, had nothing left for it but to disguise my face and rush out, knocking him over, with half his milk streaming in the gutter. Upon this he complained to the Seniors of the depredation, and on their instituting an inquiry, they soon got to the bottom of the whole evil, and made a regulation that no boy should pay away more than half his breakfast on one morning. They also kept guard on the breakfast-room.

A rage for chess succeeded to draughts, and I gave myself over to this with great devotion, to the great detriment of my advancement in the school. Instead of wholesome exercise, football, cricket, fives, &c., I confined myself with others during the hours of play to the schoolroom, over a chess-board, when the mind was excited with the same kind of feelings which are aroused by gambling, and the lassitude which follows is perhaps greater. Instead of allotting an

extra half-hour to work, to get a higher place in the Classicus Paper, I was ever contriving means to steal a game of chess, out of sight, during school hours. At the end of the second year, a new hobby took possession of me—music. One of the boys had a flageolet, another a flute, which they played tolerably. Mr. Ayling also played the flute pretty well. I had an ear, and was very desirous of accompanying, so I set to work for it on a small octave flute, and when I returned home my father gave me one of his large flutes, which he had once played very well. As I always took up every hobby with energy, I soon learned to play a certain number of tunes from notes, and to accompany. Some of the boys who had finer ears were good at setting our flutes, so as to be in perfect unison; and as there are no discordant sounds on wind instruments, at least flutes, the music we produced was by no means despicable, and among the boys greatly admired. Some theatricals having been got up, we had a regular orchestra to play between the acts—three flutes, two octaves, a tambourine, and, by way of melodious accompaniment, a triangle. The second year of my hobby I had eight flutes in *my band*, as it was called, of which, however, I was an unworthy leader, two of the others being much better players, and having taken lessons. Dr. Bayley became at last annoyed at the incessant flute playing, which was heard even at his house, but knew not how to interfere. One day I happened to observe that one of the hall tables, when set in a particular way, gave a sound very like a kettle-drum, the middle boards, which were long, vibrating, and producing a fine mellow drum-like sound. I accordingly got my band into the dining-hall, to the great delight of the boys, but it attracted a crowd in the street every evening, and gave the Doctor an excuse for putting a stop to it. Our first French master, Monsieur Flambard, an *émigré*, had now left, and in his place a Monsieur Simon (?) came, a believer in animal magnetism, and who looked like a thoroughbred fiddler. He played well, and having no person to listen to him, he wished to join our musicians, and to instruct us. But his notions of application were far beyond those which idle schoolboys could tolerate. Most of the boys liked our flutes better than the thin meagre sounds of his cat-gut,

though he really played excellently, and I suspect had been professionally in the orchestra in the London theatres. So after several unsuccessful attempts to drill us into performing an overture with him, he cut us, protesting there was not one note in tune, from beginning to end of our performance. I suppose this was nearly true, but I for one felt this aspersion on our musical talents a vile libel, and we gave out that he was jealous of the superior melody of wind instruments; and his miserable violin, and the attitudes in which he placed himself, and his cries to us not to play so loud in the 'tenderer passages,' and other directions, became a standing joke and subject of ridicule. At last we pretended that we were overwhelmed with contrition, and coaxed him back to an evening rehearsal. Just as he was performing a solo infinitely to his own satisfaction, we all, at an agreed signal, burst in with flutes, three fifes, triangles, tambourines, and every noise we could make, to the infinite delight of the bystanders; and I am sure the Enraged Musician in Hogarth would not have supplied a better subject for a picture.

About the second year of my Midhurst campaign, before Tom went to sea, Lady Ramsay (of Bamff, Perthshire) put her two eldest sons to Dr. Bayley's, induced by my father having us there (Sir James R. and his brother George, who afterwards went to Harrow). She used to have us out on Sundays once a fortnight, a great treat, principally because we got off one of the *churches*, which all boys abhor, and then we got liberty to walk where we liked. We employed the time chiefly in hunting for the eggs of partridges and pheasants. It was a great game country, and the preserves of the Poyntzes of Cowdray, Lord Robert Seymour, Mr. Blake, and others, afforded us great sport. I remember once finding a nest of pheasants, in which there were fifteen chicks and two eggs. We broke the latter, and out stepped the two chicks, and immediately thrust their heads under the egg-shells, all the rest of the body being exposed, apparently supposing that if they could not see us they were concealed. We often brought home enough good eggs to fill two coffee-pots, which were boiled next morning, and were esteemed a great treat; besides a vague notion that if detected we

might be transported to Botany Bay for this kind of poaching, added much in our estimation to the superior flavour of these eggs over those of a barn-door hen.

One of the favourite amusements of many boys in the school, during our walks, was birds'-nesting, and I learnt the egg of almost every bird in that country, where there were a great variety. I was able to climb some trees which no other boys could scale, of which I was very proud, and this accomplishment made me greatly in request on certain occasions. I remember in particular an owl's nest, which could only be taken by a long-legged and long-armed boy, who could stretch up from one bough to the next. Once I took the young owls, which were petted, and fed for some time at home. The old ones flew out in my face. My way of descending these difficult trees (fine aged beeches in Mr. Poyntz's park), for the descent was the most dangerous part of the task, was one which I found out myself. Instead of coming down by the main trunk, I got along one of the long boughs till it bent down within reach of six or eight feet of the ground, and then I let myself off. But I could never take the jackdaws' nests, which were on trees without branches, and could only be mounted by boys who had power to grasp with their arms and knees. There were many beeches of great height, which ran up like palm trees, and up which some . . .

[Here the autobiography ends.]

CHAPTER II.

FEBRUARY 1816—NOVEMBER 1817.

LETTERS FROM OXFORD—FELLOW-STUDENTS—GIFFORD—KIRKE WHITE—CHRISTABEL—EXAMINATION—LORD EXMOUTH—AMMONITES BUCKLANDI—VISIT TO MR. DAWSON TURNER AT YARMOUTH—DR. ARNOLD—GEOLOGY—JOURNEY TO SCOTLAND—TRIP TO STAFFA—IONA—RETURN TO OXFORD—LINES ON STAFFA.

HIS EARLY STUDIES.

[At the age of seventeen, Charles Lyell was matriculated at Exeter College, Oxford. He was neither a hard student, nor idle at college, but he took respectable honours in classics, being in the second class. He gave occasionally some hours to entomology, with the late well-known naturalist, the Rev. Lansdown Guilding of St. Vincent's. Bakewell's 'Geology,' which he found in his father's library, was the first book which gave him an idea of the existence of such a science as geology, and something said in it about the antiquity of the earth excited his imagination so much that he was well prepared to take interest in the lectures of Dr. Buckland, Professor of Geology at Oxford, who was then at the height of his popularity. Lyell attended a course of these lectures and took notes of them.

He paid a visit in July 1817 to Mr. Dawson Turner and his family at Yarmouth, and the following month went to Forfarshire with his father. He then accompanied two college friends on a trip to Staffa.]

To CHARLES LYELL, ESQ., BARTLEY LODGE, STONY CROSS, HANTS.

Exeter College: February 29, 1816.

My dear Father,—There is full as much necessary business here as I had at Midhurst the last year and a half. But at Corpus it is beyond everything. Although Norris has been diligent lately, fagging in the evenings and refusing

invitations, yet yesterday he and Richards, during a holiday which they had, sat five whole hours, from breakfast till dinner, working. Considering the expedition with which Norris gets over things, I think they have too much. It has prevented his writing for the Latin prize, which he was extremely desirous of. In spite of all this he succeeds to the utmost of his wishes in keeping up among his acquaintance the highly honourable and fashionable title of a complete idle fellow. And it amuses me not a little to hear a certain friend of his, who is not over desirous that N. should outshine him, so far as to take a first class, deplore the manner in which 'so clever a man *throws away his abilities!*'

I have become acquainted with several gentlemanly men here, but as I at present know nothing about them, I will not fill the letter with empty names. Mr. Selwood has this moment been here to ask me to breakfast with him tomorrow. Unfortunately I am engaged. I have subscribed to the music room three guineas, being told by my *out-college* acquaintances that I might be sure all the men here did, and that I should be forced to go now and then, which would amount to more than the subscription for the year. There is to be no grand music-meeting here, although it is the third year. I believe the Imperial visit[1] is to be thanked for it, which disburdened the University chest of rather more than 6,000*l.* It will be long, they say, before it is encumbered with so much again. I have been into the theatre, to see the magnificent chairs which the great people sat in, and the *Rostrum*, which I should like to be reduced to the awkward situation of being exposed in. They have begun a reform at Trinity, at least as far as the enormous expense. Everything which goes on there is inspected, and one of their gentleman commoners told Norris yesterday that he should take his name off positively, for the Principal has declared that not an *ice* or a *pine-apple* shall enter the college! Dreadful extremity!

Believe me, my dear father, your affectionate son,

CHARLES LYELL.

[1] The visit of the Allies to England in June 1814.

To CHARLES LYELL, ESQ., *Bartley Lodge, Stony Cross, Hants.*

Oxford: March 20, 1816.

My dear Father,—I have got Gifford's 'Juvenal.' A short life of the author, written by himself in the most unaffected style possible, which precedes the translation, will prejudice you much in his favour. His mother, he tells us, was a carpenter's daughter, and his father scarcely so respectable. He was bound apprentice to a cobbler, and his first attempt at versification, indeed the first time he had heard of it, was a competition between his brother apprentices about writing some lines for the sign of an alehouse. So true it appears that great obstacles are rather assistants than otherwise to genius; indeed, he confesses that nothing would have ever induced him to finish his translation after he had arrived at a state of affluence, unless he had received a subscription while at this college, which obliged him from motives of honour to fulfil his engagement.

With Kirke White I was acquainted a long time ago, having met with his 'Remains' at Midhurst. There is a delicious poetical, placid melancholy, which pervades almost all his writings, either in prose or verse, which is very interesting; and nobody, we may venture to assert, ever joined a more amiable disposition to a more elegant mind. A small ode of his to 'An early Primrose' is the only thing I know in English in the light way, which supports itself thoroughly without rhyme, so as to be as beautiful as any of Cowper's. I can conceive nothing which would give a person, who knew nothing of Latin, a better idea of what the Odes of Horace may be, though so distinct from our poetry.

I have gone to the expense of an Oxford Calendar, for fear of being too strictly examined in Hampshire. I shall now shelter my ignorance with 'read, and you'll know.'

The decision of the Property Tax has decided not a few bets this morning, and caused great joy *here*, though by no means general exaltation through Oxford. This is a complete Whig college, which you need not go twice into the common room to discover. They pretend that it was by far the greatest support of Lord Grenville, which is sufficiently improbable; because, though we are strong in the number of

resident members, the number of names on our books is very few, consequently there are some colleges much smaller who have double and treble the quantity of votes. Most of the men here come from Devon and Cornwall, and who of course, when they have taken their degree, never think any more of this part of the world.

My love to all at home, and believe me, my dear father, your affectionate son,

CHARLES LYELL.

To CHARLES LYELL, ESQ., *Bartley Lodge, Stony Cross, Hants.*

Exeter College, Oxford: May 14, 1816.

My dear Father,—I have just been down to Dr. Williams. He is not at home to-day, but I called there yesterday with Tragitt, and thanked him for the roses. There is a most beautiful wild flower lately opened in Magdalen meadows, which reddens the whole meadow. I saw a plant of it in the Botanic Garden, and there was written on the stick, if I remember right, *Fritillaria Meleagris.* But it does not flourish in the garden, for I suppose it to be some water plant.

I was very glad to hear you were satisfied with the verses,[2] as I shall now care less about a disappointment, as they certainly have not been written in vain. I am afraid you have no idea how backward I find myself in classics. Though I did not come here puffed up with Deacon's high ideas that I should shortly become the first scholar in Oxford, and though I am not such a Cæsar as him, who, when he found he could not reach the height of his ambition, determined in despair never to look in a book again, yet I am confidently sure, that without working very hard indeed, I shall never arrive at the 'Mediocriter,' or at least never pass it.

I cannot help being sorry when I reflect that since last June, when I left Midhurst, I can only say I have read the Odes of Horace! For as to Herodotus, that part which I thought I knew perfect, I found the other day, in the schools, I knew nothing of, so puzzling are their questions in history. I was hearing a Corpus man examined. And here

[2] *The Horses of Lysippus*, by C. Lyell.

is June coming round again! The list of books which they take up for an *under-the-line* is very great, and the examination strict. C., the man of C. C. C., showed us what was to be done by attending to the Corpus lectures. He has always been otherwise an idle, dissipated, *gaming* man, notorious in name, even to my knowledge. Yet he certainly would have got a first class if he had taken up a little more Aristotle.

I heard a story out of college the other day, which, though probably made in the first instance, shows in what estimation the *Devonshire*-Exeter-men were held when the college was entirely provincial. Now the greatest part of those West-countrymen that remain have rubbed off their dross in our public schools. This story is, that one of our men being examined for his degree, was asked, for the first question in divinity, 'who Moses was?' 'Moses?' he answered, 'knows nothing about Moses, but ax me about St. Paul, *and there I has ye.*' There was a concert here last night, Matthews on his way from Bath, and performed gratis.

My love to all at home, and believe me, dear father, your affectionate son,

CHARLES LYELL.

To CHARLES LYELL, ESQ., *Bartley Lodge, Stony Cross, Hants.*

Exeter College: May 30, 1816.

My dear Father,—There is an address gone from Oxford, as perhaps you saw by the papers. It takes away the Vice-Chancellor, Proctors, &c. &c., by which means the prizes will not be decided this fortnight perhaps. There were sent in sixty-four copies for the English, double the usual number. Ellison, the tutor of C. C. C., who was elected Fellow of Baliol last term, and who is one of the cleverest men there, offers to take any bet in favour of a Baliol man, whose verses he thinks fully equal to any which have ever gained the Newdigate. I have seen a copy of this college, which I am afraid would be preferred to mine, as they lay more stress on describing the horses. The men here have taken a good deal of interest about 'Christabel,' as the author is an uncle of our Coleridge.[3] The criticisms in the 'Times' are so

[3] Lord Chief Justice Coleridge.

good in general on dramatic pieces, that I was surprised to see anything so bad as that on 'Christabel.' You would take it for a long poem, from that flaming account, instead of a thing about as long as that column and a half in the 'Times' about it. You would read it through at breakfast easily.

Its appearance now seems very strangely timed, though the 'Times' finds, as a cause, the 'Indolence of Genius.' Ushered in by Lord Byron's recommendation, and supported by this puff, I can't help considering it as a vehicle to raise money. There are certainly poetical beauties in it, but it is curious that when Scott had shown us all the powers of this new style, the original discoverer of which certainly deserves infinite praise, and when he had himself exhausted it, and the 'Lake Poets' had increased our fastidium, and the *Imitatores servum genus*, had worn it out—when it had flourished in youth, and died a natural death in old age—then is produced its birth! It is rather like a prophecy which is related after the event. Though you don't wish to dispute the fact, one cannot help thinking it a pity that it was not told you before the circumstance fell out. But the evil is, the public must feel it in some manner their duty now, when all the pleasure of novelty is fled, to give Mr. Coleridge a great part of that unbounded applause which Scott carried off. But my opinion of Scott is not at all diminished. I lay so much stress on the style, because it strikes me in that consists all the originality. In the story there is not a clue, nothing to interest you but *singularity*.

I daresay you will laugh at my presuming to pass my opinions on this, with all the insolence of the 'Edinburgh Review,' unsupported by their soundness of judgment, but I have my excuse. It is the common vice here, *Defendit numerus*,—a latitudinarian principle, I confess.

Give my love to all at Bartley, and believe me, my dear father, your affectionate son,

CHARLES LYELL.

To CHARLES LYELL, ESQ., *Bartley Lodge, Stony Cross, Hants.*

Exeter College: Thursday, October 31, 1816.

My dear Father,—You will be surprised to hear that the examination is over, and, much to my satisfaction, I have

had but few days here, but I do not know what I should have done without them. As soon as I arrived here, and it was known that I meant to go up, I was sent for before the three tutors. Jones evidently was offended, that after attending his logic lecture for a term, I had thought myself so ignorant in it, as to choose mathematics; but Dalby was still more so, because, after refusing to attend his mathematics, I had taken them up. 'And how did you get them up? And when? Who assisted you?'

He told me to come to his rooms, and unless I was advanced a certain way, it was ridiculous to think of passing. He found me perfect in the propositions taken singly, but he puzzled me dreadfully in general questions about the relation of one to another, and he dismissed me peevishly. 'Well, you can go up, but you will make but a very, very poor show!'

I worked most perseveringly all the week, and when he examined me afterwards, the day before I went up, he declared me marvellously improved. I was the last on the list, that is of the eight who were examined the same day, and they gave me, to employ the time, three propositions to prove on paper which were not in Euclid, which, as some of my companions who took up six books could neither make head or tail of, they gave me great *κῦδος* for doing correctly, and gave me another stiffener, the proof of which I got at, to their surprise, though they said it was neither by the shortest road nor by the way they intended. Horace and Sophocles went off without a blunder, except in the declension of one unfortunate Greek noun. Dalby gave me the *viva voce* examination in mathematics, but he did not give me one of the questions which he did in preparing me. He paid me some flattering compliments this morning after an Aristotle lecture, but I am well aware that it was not solely because I did well, but because he thought I should have done so much worse.

Speaking of Aristotle, I was surprised to find what a number of deep scholars there are, even in this college, which has but till very lately not pretended to bear any great literary character. It is no presumption in me to say that Dalby has chosen the picked men of the College, though I am included, since I found myself so infinitely inferior to

the greater part. I was thunder-struck to find that Enys, one of the idlest of our gentlemen commoners, a Winchester man, who seems to attend the lecture as a mere lounge, and who never intends to take a class, acquits himself better than I do, when I get it up carefully. They all, however, almost, are above my standing, and have read other parts of Aristotle. He is an astonishing stiff author. It is the seeing the superiority of others that convinces one how much is to be, and must be done, to get any fame; and it is this which spurs the emulation, and feeds that 'Atmosphere of Learning' which Sir Joshua Reynolds admirably describes as 'floating round all public institutions, and which even the idle often breathe in, and then wonder how they came by it.'

I was surprised at Ramsay's [4] calling on me the other day, though I owed him a call.

He seems to have been delighted with his call at Kinnordy. He came into the gallery to hear me examined yesterday, but had not patience to wait till my turn, which a great many kind friends did; and the rush they made from the top benches to the lower ones, when I was called up, so completely deprived me of all confidence, that it was not till after many exhortations and entreaties that I could raise my voice enough for the masters to hear me.

As for the confidence and quickness which you were speaking of, as one of the chief requisites of the Bar, I don't know whether intercourse with the world will supply it, but God knows I have little enough of it now in company, and I was surprised at feeling so much unconcern as I did in the Schools, but that was no criterion, since all things flowed then *secundo flumini*. Lord Exmouth [5] paid a second visit here last week: he was presented with a Doctor's degree the first time, and the last with the freedom of the city. Our Rector was honoured with his last visit, therefore we got a good view of him.

We have had torrents of rain here these last two days. I hope it is not so in N. B. Ramsay describes the tenants at Bamff as being in as miserable a state as any of those

[4] Sir James Ramsay, Bart., of Bamff, Perthshire.

[5] Admiral Viscount Exmouth, who bombarded Algiers, 1816.

round Kirriemuir can be. I have not heard from Bartley since I have been up, but I shall write to-morrow, and believe me, my dear father, your affectionate son,

CHARLES LYELL.

To CHARLES LYELL, ESQ., *Bartley Lodge, Stony Cross, Hants.*

Yarmouth:[6] July 20, 1817.

My dear Father,—I got to London after not a very good night's rest, which I attribute more to the length of my legs than any other cause. I am sure I could sleep soundly if they could be shortened, but as I have no wish to undergo an operation like that practised with so much success by Procrustes, I shall hope that some opposition coach will be established, deeper and longer, to tempt the long-legged. As soon as I arrived at the Gloucester Coffee House, I dressed, put my letters in the post office, took my place in the Norwich coach, and walked to Sowerby's.

When searching about the Row for his house, behold the very identical Ammonites Bucklandi[7] was lying on the steps! I went in and introduced myself, telling him by what means I had discovered his house. 'Ah,' said he, 'little I believe did they think at Oxford what advantage I should take of that joke. I hear Buckland was perfectly astonished when he read it.' I exclaimed involuntarily, 'Well he might be,' which he took in good part, laughing heartily.

I visited the cast of Phidias and (talking of things on a grand scale) the elephant at Exeter Change; also Bullock's Museum—got several commissions from Bullock to Mr. Hooker.[8] Saw the whole of Francillion's collection of foreign and British insects, the first in the world. Might

[6] On a visit to Mr. Dawson Turner, F.L.S., antiquarian and botanist.

[7] Remarkable for having frequently lost the inner whorls, which circumstance has given rise to its name, in honour of the Rev. W. Buckland, who, having found a large specimen, was induced by his ardour to carry it himself, although of considerable weight, and being on horseback it was not the less inconvenient. But the inner whorls being gone, so as to allow his head and shoulder to pass through, he placed it as a French horn is sometimes carried, above one shoulder and under the other, and thus rode with his friendly companions, who amused him by dubbing him an *Ammon Knight*.

[8] Sir William J. Hooker, F.R.S., F.L.S., author of many important botanical Works, and Director of the Royal Gardens at Kew.

have identified all I wished, but, as you may imagine, had only time to write down the names of a few. The famous Kangaroo Beetle, the only one ever taken, is a Scarabæus, its hind legs of wonderful length and size, though I confess I admired it as the father in Horace his pet child:

Hunc Varum distortis cruribus.—*Sat.*

Let those who wish to have an idea of the magnificence of Nature, visit the elephant, those who wish to judge of her *varietas insatiabilis*, see Francillion's collection. I saw Sir James Smith [9] at Norwich and the Linnæan insects, with some British added by Kirby. Saw the cathedral, and view from the spire, and found an immense number of Belemnites, Echinites, and bivalves in the chalk-pits near Norwich. Set off by the afternoon coach and arrived here safe. All well here, and desire their kind remembrances to you. Dr. Arnold,[1] the Javanese traveller, is indeed impenetrable, but you soon see he has much in him. The only subject on which he launches out is on Fossil Remains, and then only if you get him quite alone. He has a large collection here, obtained from Norfolk and Suffolk, of Echini, Ammonites, and mostly Alcyonia found in flints. He has had the good nature to go over them all with me. I have copied for Buckland part of his paper, being a list of those which are described, and shall copy the rest. A very large part are nondescripts, which he thinks of publishing. A Mr. Wigge, a botanist, who breakfasted here this morning, wished to know particularly if you had discovered any new Jungermannia, and why I, being in the New Forest, where you have found so many, did not also take up botany. He is a character, but a very good-humoured, pleasant old man. Mr. Turner surprises me as much as ever. He wrote twenty-two (!) letters last night after he had wished us good-night. It kept him up till two o'clock this morning, it is true. A great many letters are constantly arriving from

[9] Sir James Edward Smith, botanist, founder of the Linnæan Society, b. 1759, d. 1828.

[1] Dr. Joseph Arnold, F.L.S., a zealous naturalist, who accompanied Sir Stamford Raffles, the governor, to Sumatra, and fell a sacrifice to his exertions on their first tour into the interior, when they discovered the gigantic flower of a new genus of plants, afterwards named *Rafflesia Arnoldi*.

travellers abroad, which he entertains us with by reading. His smack scheme was a good one, after all. They always know by signal, regularly kept up, of the arrival of Scotch smacks in the roads, nine hours before they can come opposite the town.

My dear father, your affectionate son,

CHARLES LYELL.

To CHARLES LYELL, ESQ., *Bartley Lodge, Stony Cross, Hants.*

Yarmouth : July 28, 1817.

My dear Father,—I received your letter yesterday, and am not passing my time less pleasantly than you conjectured. What I see going on every hour in this family makes me ashamed of the most active day I ever spent even at Midhurst. Mrs. Turner has been etching with her daughters in the parlour every morning this week at half-past six! Harriet has as much talent as all the others united, and her knowledge of Latin is astonishing. She has a more perfect conception of Virgil than I had at fourteen, and earns a shilling at least three times a week by doing her Latin composition without a fault, and does all with energy and good will.

Dr. Arnold returned on Saturday, after being away four days. I was very glad of it, for as Mr. Turner has been much employed in the bank, I have had time to examine and consider the geological wonders of this country. The Doctor says my conclusions are exactly like his, which nobody ever knew he had made, and has become in consequence very communicative, and quite another person. Yarmouth is a delta formed at the mouth of the Yare. When first these sands rose, by the opposition of the sea-tide and river, Norwich was a great seaport (as we find records of), the violence of the tide being kept off by that bank, the estuary filled up with 'fluviatile detritus.' The Yare then wound through the present marshes, and entered the sea north of Yarmouth (Mr. T. says 'No'). The reason that it then turned off at right angles was, that the mouth being stopped up by the sea, it was obliged to find a new course, and the north river meeting it there, it flowed with it, southward, and entered a little south of the town, then two miles

farther off, then four miles, at Gorleston, where the pier is, which you saw. All these ancient channels I found, and the Doctor confirmed them, though Mr. Turner laughs in spite of facts and tradition. The last movement of the river threw inland at least a mile of perpendicular sand, cliff 15 feet high, on which the village of Gorleston stands. The terrace or platform on the top of this cliff is on a level with the marsh land reaching to Norwich. A friend of Mr. T.'s told us yesterday, that thirty-five years ago he could stand by the river, and see the hulks of the ships over the Deens, which rise now six feet and more, too high on the sea side for such a prospect, and yet the sea has not been over them all that time. Dr. Arnold and I examined yesterday the pit which is dug out for the foundation of the Nelson monument, and found that the first bed of shingle is eight feet down. Now this was the last stratum brought by the sea, all since was driven up by wind, and kept there by the 'Rest-harrow'[2] and other plants. It is mere sand. Therefore, thirty-five years ago the Deens were nearly as low as the last stratum left by the sea; and as the wind would naturally have begun adding from the very first, it is clear that within fifty years the sea flowed over that part. This, even Mr. T. allows, is a strong argument in favour of the recency of the changes. Dr. Arnold surprised me by telling me that he thought that the Straits of Dover were formerly joined, and that the great current and tides of the North Sea being held back, the sea flowed higher over these parts than now. If he had thought a little more, he would have found no necessity for all this, for all those towns on this eastern coast which have no river god to stand their friend, have necessarily been losing in the same proportion as Yarmouth gains, viz., Cromer, Bakefield, Dunwich, Aldborough, &c. &c. With Dunwich I believe it is *Fuit Ilium*.

The Doctor told me that he has always thought that it was the meeting of the great north current with that of the English Channel that burst open the Straits of Dover. With this I was delighted, for he did not know that to the very same cause both Werner, Humboldt, Buckland, and others,

[2] *Ononis arvensis*.

as well as myself, have been attributing the existence of Great Britain as to its insular and probably political situation, and by means of which it must for ever maintain the former, and will, let us hope, the latter also for a very long time. Had not the Yare been turned off, as I told you, at right angles, it would have split into the *Septem ostia Nili*, and Yarmouth would have now been an extensive growing delta. All the acquisitions are now making southwards, of course.

A Mr. Edwards, an entomologist, dined here yesterday. I have found some Coleoptera scarce at Bartley. I have been learning Musäus's 'Hero and Leander,' a Greek poem which is very beautiful. Mr. Turner has it at his fingers' ends. We play chess every evening. I have played twice with Mr. T., and beat him once. Miss Elizabeth plays nearly as well as he does. Mr. Turner has given me some plates of mosses for you, I believe from Mr. Hooker.

Between Dr. Arnold's long catalogue of Norfolk fossils, and a map which I think I shall be able to make of this country, I flatter myself I shall compile some interesting information for Buckland, who is quite of White's opinion. 'Local information, from actual observation, tends more to promote Natural History and Science than all that is done by the speculations and compilations of voluminous authors.' I want to find chalk cliffs at Norwich, which must exist, I am confident, and I think I shall have an opportunity of going there this week.

Pray give my love to all, and believe me, my dear father, your affectionate son,

CHARLES LYELL.

JOURNAL.

[Extracts from Journals in August and September, 1817, while travelling with his father to Forfarshire, and afterwards on a trip to Staffa with Sir James Ramsay, Bart., and Mr. Corbett, of Christ Church, Oxford.]

August 20, 1817.—The York coach carried us out of London early in the morning. The tunnel at Highgate was a new object, it was dug through the London clay almost entirely. We took a chaise to Helmsley in going out of York, and saw Lord Fitzwilliam's carriage and six, with six outriders, and his son Lord Milton's carriage and four, with four outriders, both beautiful equipages. Lord F. runs a good many horses, and gained most of the plates this year. Lord Harewood was there; his equipage exactly the same as Lord F.'s; he runs no horses. Mr. Fawkes told my father that in the grand election contest between Lord F. and Lord H., to get their sons in for the county, when Wilberforce was brought in free of expense, it cost each of them 200,000*l.* Lord Lascelles was ousted, but the majority in favour of Lord Milton was very small. Lord H. immediately raised his rents 10,000*l.* a year.

At a small hamlet near this we saw an *Ulmus montana*, on a steep 'brae,' the most beautiful study for a landscape that can be imagined. A sort of stone work has been built under it, evidently to prevent the chance of such a treasure falling by the wind. We changed horses at Helmsley, and went through Duncombe Park. The old castle at the entrance is a fine ruin.

> And Helmsley, once proud Buckingham's delight,
> Slides to a scrivener, and a city knight—

alluding to this castle, and the present proprietor of Duncombe Park. This was not the first entrance to this beautiful seat which we had passed to-day: the first was a large arch with this inscription—'To the memory of Lord Nelson, and the unparalleled achievements of the British Navy.' In ascending the Black Hambleton Hills, we passed up a very

deep narrow glen, without a river (unfortunately for the Huttonians), and in descending the same hills we had a beautiful view of Whitestone Cliff, and Gormire, a tarn on the top of a conical hill. From thence we saw the whole valley into which we were journeying.

I walked to Sowerby, a small village near Thirsk, and learnt from an old stonemason there, of the name of Dukes, that the lake of Gormire, which the common people think has no bottom, was fathomed once, and its depth was seven fathoms. The bottom is probably sandstone, as the whole hill is quarried for that rock. There are so many springs, that the crater overflows even after long droughts. Grouse are found on the Black Hambleton range, and the Duke of Rutland shoots there generally every year. These hills consist of magnesian limestone. The whole face of Whitestone Cliff fell down about twenty years ago, and left it in its present perpendicular state. It was dusky when we approached Newcastle, and the collieries made a magnificent spectacle. The heaps of loose small coal catch fire accidentally, they say, on account of the pyrites, which is highly probable. We slept at Newcastle.

August 24.—We dined at Dr. Headlam's,[3] and they showed us Sir Humphry Davy's newly-invented safety lamp. The dispute concerning the priority of invention (or rather the doubt entertained, for Sir Humphry has not condescended to notice it) is warmly espoused by Dr. Headlam in favour of Stephenson.[4] A service of plate has been voted to Sir H., which is to cost 15,000*l.* at least. There are large iron-works near Newcastle, and lead-mines. The workers of the latter are very destructive poachers of the muir-fowl of the hills; for having powder allowed them to blow the stones with, and being able to cast shot themselves, they have ammunition put into their hands. There are several steam-boats on the Tyne. The *Eagle* packet carried 500 people by way of experiment: 250 it accommodates pleasantly.

August 25.—We got into a coach to go to Edinburgh, where we called on Jamieson in George's Square. He could not show us the museum and collection, as they are packed

[3] A cousin of his mother's.

[4] The eminent engineer.

up, on account of the college being at present building. The Regent's Bridge, which is nearly finished, will make a grand entrance to the town. We walked on the Calton Hill, and admired the new walks. There are a greater number of striking views from different points of this town than any place I ever saw in nature, or painting. The new prison is built with great spirit, and from the bridge forms a good support to the Nelson monument.

August 27.—We dined at Mr. Mason's.[5] He told us that a few days before, Sir H. Davy had given him an account of an artificial island formed by a Cornish miner in the sea, to get at a mine (of either lead or copper), which was truly wonderful. Mr. Mason, speaking of the Crown Church at Edinburgh,[6] told us that the pinnacles of Gothic architecture are not mere ornament, but indispensable, for unless an arch is loaded, it flies at the top, its first tendency being to fly at the bottom. This of course it cannot do in ground arches, but in the arches of the Crown it was necessary to add those ornaments, which I think disfigure it much, and make the Crown of Edinburgh much inferior to that of Newcastle. The next disposition is to fly laterally when secured at top and bottom : an additional weight therefore is added to the centre. In the Roman semicircular arch the shape was perpendicular. The Grecians had none, which is very extraordinary.

August 28.—We had engaged places in the Dundee coach, and set off early. Leaving Kinross, we came to a most beautiful glen, called Glen Farg, well wooded, and with a small river passing through it, which tumbled over the rocks the whole way. We could get no horses at Dundee, and were obliged to sleep there. I walked to the top of Dundee Law, where there seems to have been an old fortification, perhaps Pictish. We travelled over the Siedlaw Hills : the rock was whin[7] chiefly.

September 1.—Kinnordy. I walked up towards Glen Prosen ; the banks of the Prosen consist of whin wherever they are rocky ; took several *Phalænæ*. The rocky glen

[5] Laing Mason, of Lindertis, Forfarshire.

[6] St. Giles's Church.

[7] Whinstone, a Scotch provincial term for greenstone and other hard trap rocks.

formed by the Carrity is through whin. Took *P. napi* and *polychloros; Sylpha atrata*, and a new one, *S. stercolarius, fimelarius*, and several *Phalænæ*. Afterwards I examined the Kirriemuir quarry, an enormous rock of red sandstone, with a little *terra ponderosa* or sulphate of Barytes in it. We found this same earth afterwards in greater plenty in Mr. Mason's quarry at Reedie.

September 3.—We called at Cortachie and saw Lord Airlie. I rode to Forfar and examined the slate quarries. They told me they sometimes found in the slates the impressions of plants and animals, but they showed me no satisfactory specimens. I then rode four miles farther on the old Brechin road, to some slate quarries, where I obtained some crystallised sulphate of Barytes, if I am right in supposing it to be such. I have not seen the *terra ponderosa* in sandstone, whin, and slate. The vein of it in the quarry two miles from Forfar, on the Dundee road, is very considerable.

September 6.—Rode to Finhaven over the bridge of Shielhill, through Tannadice. At the foot of the castle hill is the old ruin of the castle; at the summit a large vitrified fort, length 160 yards, breadth 40, as near as I could measure by stepping; height of mound or wall, 10 feet. The western side of the hill is a considerably lower level, and at this part there is an excavation 30 feet deep or more.

Trip to Staffa.

September 14, 1817.—Set out on a tour to Staffa with Sir James Ramsay and Corbett (of Christ Church, Oxford). Passed through Blairgowrie, and following the Tay through Athol, we arrived at Aberfeldy, and saw the Falls of Moness in all their beauty: the accompanying wood and enormous cliff are only surpassed by the fall itself. Saw Schiehallion in the distance. Slept at Kenmore.

September 15.—Rode by the side of Loch Tay. We stopped at Killin, the town on the western end of Loch Tay, where the rivers Dochart and Lochy, uniting, form the loch. Lord Breadalbane's grounds occupy both sides of the lake: they

are well wooded—oak, birch, larch, hazel, alder, and ash. Ben Lawers we could hardly see for the mist. Visited the Castle of Finlarig, which our learned host, a Cameron, informed us signified etymologically Larig the abode, Fin of Fingal, and Killin itself was Kill the churchyard or burying-ground, In of Fin or Fingal. I was surprised to find that the people here spoke English so infinitely better than those in Angus, but they told me it was taught them at school as Latin was, Erse being so exclusively their native tongue. They showed us the grave of Fingal, and MacNab's burying-ground, with the Dochart roaring around us.

September 17.—We set off for Tyndrum, through Glen Dochart, and after sleeping at Dalmally we proceeded along Loch Awe, passing under Cruachan. After this, we had the finest mountain view I had ever seen. On our right was Ben Cruachan, some way off Ben Lawers, and the prospect terminated by a fine conical hill. After riding past Bonaw we saw a monument to Lord Nelson, which a person might feel more proud of than of all the columns and pillars erected to his memory by committees of counties and towns. An immense mass of unhewn granite, of a beautiful red colour, has been erected by the Lorn furnace-workers, the people employed in the iron-works. They found it in the valley, and have brought it to a small hill, from the summit of which it forms a conspicuous object. It is about twelve feet high. The country from thence to Oban is very singular. You pass by high cliffs of whin, rising suddenly here and there, yet you have never to mount any, but seem going through the cracks in a torrent of lava. One view from here of Cruachan with a double peak was very fine. We arrived at Oban by the middle of the day, and engaged a small cutter. We passed Kerrera and came near Lismore. The next morning we came into Aros Bay, the hills of Mull on the west, and the Morven on the east. Aros is a collection of two or three small houses and the ruins of an old castle. We landed and walked to the head of Loch-na-Kael, took a boat there, and sailed down Loch-na-Kael with a prosperous wind, and had a fine view of Ulva, with its ranges of basaltic steps, like Salisbury Crags, Edinburgh. I believe we counted thirteen. We arrived at Staffa in the

evening, and the wind being northerly we were able to enter the cave, with the width of which I was much disappointed. When the boat was in they could nearly touch each side at once with their oars. The height is magnificent, and two or three broken lines of columns at the bottom on each side form a superb base to the pillars. The roof, hung with the broken heads of pillars, is likewise grand.

There was a slight agitation and swell of the sea, which prevented us from going in very far. The wave which entered sucked us in, and the boat sunk at the same time several feet. We then heard the wave creeping up towards the end of the cave, till it struck against it, we in the mean time remaining motionless: then the wave returned, and gently heaved us up, and carried us to the mouth of the cave. This was very fine, but after two or three trials we rowed away for fear of an accident. The pillars in the Boats' Cave are higher and finer than those in Fingal's, but a striking part of the entrance of Fingal's is that the pillars are ranged in a fine rounded swell on each side, instead of being straight in the manner of a wall. With the beauty of Buachaille and the cliff we were astonished and delighted. The Clam-shell Cave is also curious.

Instead of returning to the inn at Ulva, which we had intended, we went on to Icolmkill that evening, as Mr. McDonald of Ulva, to whom we had letters of introduction, was not at home. It was late when we landed at Iona, but the landlord of the inn and his family had not returned from shearing. We were obliged therefore to go into 'But,' in as miserable a specimen of a shieling as can be imagined, a conical hut open at top, with a large fire on the ground in the middle of the floor. Round the walls above us were immense stores of dried fish, tied two by two, and slung over a rope: it appeared a winter's store. The whole was dirty in the extreme, and *lacrymoso non sine fumo*, as may be supposed. When the landlord returned, and we were introduced into 'Ben,' we were but little better off, the smoke, our great enemy, being as dreadful as ever.

To avoid this, and relieve my eyes, I walked out. It was moonlight, and the finest aurora-borealis I ever witnessed was lighting up the east. The ruins of the abbey appeared

to great advantage, but they are but poor after all. Sir James got a bed at the schoolmaster's, and Corbett and I slept at the inn.

September 20.—The children crowded round us in the morning, with Icolmkill pebbles to sell. They are Serpentine, which they find on the beach, very unctuous to the touch, and yellow.

The schoolmaster, McLean, showed us the antiquities, and told us the customary story of the interment of St. Oran, &c., and pointed out the tombs of the kings of Ireland, Norway, and Scotland. There were two fine crosses standing seven or eight feet high, of which there were once 360 standing. They were all thrown down at the time of the Reformation. The Coltsfoot[8] flourishes most magnificently over the tombs, and hides much of the rubbish and treasures. The ruins of the church look like so many gable ends of houses, set up rank and file, and one of the inducements to go directly from Staffa to Iona might be to contemplate the triumph of the architecture of nature over that of art.

McLean informed us that the inhabitants now on the island, who amount to 450, only hear divine service four times a year, and not that often, as the roughness of the weather sometimes prevents the Presbyterian clergyman from coming over from Mull, for Iona belongs to a parish in Mull. He preaches in the open air, and in English, which part only of his congregation understand. What a change from the state of the island when the monks had service morning and evening. The schoolmaster, it is true, reads prayers every Sunday, but, as he confesses, no one scarcely but his scholars will attend. He teaches them English only, which they speak fairly. The islanders seem to exist by their fishing. Their only traffic is kelp, and a few black cattle which they rear. We saw some black cattle embarked, which was a very amusing and ridiculous scene. A rope is tied to the horn of the animal, and he is driven to the sea-side. At first they make violent resistance, and the driver, while they are kicking and prancing, yields with the rope, and lets them exhaust themselves, as an angler does a large trout. They show great dexterity in always keeping in front

[8] *Tussilago farfara.*

of the animal. The beasts are then pulled into the sea, into which both men and women walk with as much unconcern as if they were by nature amphibious. The fore-legs of the animal are first lifted up by one person on each side, and then the hind. We saw one lassie seize hold of the tail, and help to lift him in that way.

About half-past nine, after having paid an enormous bill for our bad entertainment, we set off in our Aros boat, determining to get back to Oban by passing along the south of Mull. The immense multitude of small granite rocks which we passed through was very entertaining. This south-west end of Mull is a coast of red granite, and in McLeod's Bay it takes a decided columnar shape, the pillars being four-sided, whereas most of those at Staffa which we examined were pentagonal, none square. There is a large creek in this bay, with the pillars on each side about 150 feet high, and broken into regular steps like the basalt. Between these two cliffs, which face one another, and are only divided by a large rent two or three feet wide, a large rocky mass is supported. We sailed on with a good breeze, the granite structure in the coast still continuing. The small islands were like so many Buachailles, the coast like so many churchyards, pillars standing up with their square sides, like tombs. The last point to which this reached, they called Ardtornish, about four miles from McLeod's Bay.

CORRESPONDENCE.

To CHARLES LYELL ESQ., KINNORDY, FORFARSHIRE.

Exeter College: October 21, 1817.

My dear Father,—I find so few of my old acquaintance come up this term, that I could almost fancy it a new college. It will be less difficult, therefore, to acquire what Paley so strongly recommended to his pupils, 'courage to be alone.' Ramsay tells me there are four new noblemen and eight gentlemen commoners this term. We have only one of the latter—the son of a man of consequence in Ceylon.

He is a copper-coloured black, under the care of Lord Bathurst. Our Government educated his elder brother, as they are doing this one, first under a private tutor, then at Trinity Hall, Cambridge. They say, but I believe without any foundation, that he is a nephew of the King of Candy. His manner is very pleasant, and he talks admirable English. He is to take orders, they think at present, and then follow his brother to his native country. His name is M. de Saram.

I saw Dr. Arnold in London, since which I received an unexpected letter from him at Portsmouth, chiefly to inform me that he had just discovered a paper written in the last number of the 'Geological Transactions' by Buckland, on flints owing their formation and shapes entirely to animals. The pear-shaped flints we saw with Mr. Taylor at Norwich are touched upon in it. Now that the time of parting is come, the Doctor seems almost to shrink from the thankless and dangerous task before him.[9]

Dr. Williams tells me that Buckland will not be in Oxford till late this term, if at all. He has not been on the Continent this long vacation, but making several 'home circuits.'

When I was at Muddiford [1] the other day, I found the cliff composed of what I think must be decidedly the green sand of Werner, which you remember Phillips says always accompanies chalk. I found at Bullock's Mona Marble Exhibition in Town some fine specimens of Serpentine among the unpolished rocks, some of which are precisely the rock at the *Bridge of Cortachie*, with that green, shining, glutinous matter on the outside, but none of course with the porcelain appearance, which must be owing I think to heat. I spent the morning at the British Museum, studying the collection of minerals, a very great and splendid treat.

I received a letter this morning from Mr. Turner, sending me an etching of Captain Manby and Talma, much good advice, and an invitation to spend my Christmas vacation at Yarmouth. I seem to have been at Yarmouth a day or two ago, so very near did we pass within the roads. The sail

[9] Going with Sir Stamford Raffles to Sumatra.

[1] A bathing-place near Christchurch, Hants.

up the Thames, at the rate of twelve knots an hour, with generally 300 vessels near us, moving rapidly in all directions, was delightful beyond description. A side wind shows off every vessel in the most picturesque view.

> One side on high, one buried in the deep,
> Her deck to meet the ocean, slanting steep,
> Beneath the swelling sails her mast bowed low,
> She mocks in speed the following breakers flow.
> Back from her bows the broken waves are cast,
> And far behind her in the moving waste
> A level track declares her well-sped way,
> Where swiftly circling sports the eddying spray.

I admire my mother's picture [2] very much—a strong and pleasing likeness, nor should I have discovered its unfinished state at the usual distance of viewing it. Believe me, my dear father, your affectionate son,

CHARLES LYELL.

To CHARLES LYELL, ESQ., KINNORDY, FORFARSHIRE.

Exeter College: November 11, 1817.

My dear Father,—I have been sitting in the schools for seven hours this morning, a ceremony which I must undergo again before I am qualified to go up myself. The day was almost entirely taken up with Baring,[3] a gentleman commoner of Christ Church, son of an East India Baring of immense property. His examination will last perhaps three days more, as he goes up for a first class in *both*. He went on to-day in a splendid manner. He is a young genteel-looking man, and has mixed with society in Christ Church pretty freely since his residence. He was examined to-day in Aristotle's *Ethics*, *Rhetoric*, Thucydides, Herodotus, Polybius, Xenophon, Livy, Euripides, Sophocles, Æschylus, Virgil, besides *Divinity*. The examinations are expected to be unusually severe, and it is feared there will be many before the end of the term.

I had a letter this morning from Guilding, from the island of St. Vincent, favoured by the Hon. W. Edwards, H.M.S. 'Hydra,' now at Portsmouth, who was to have delivered it to

[2] By Thomas Phillips, R.A.

[3] Son of Sir Francis Baring, and afterwards first Lord Northbrook.

me here, and been lionised by me over Oxford, but is detained from doing so at present. Guilding had procured then (17 September) 700 entirely new species of insects, one sphinx measuring eight inches from tip to tip of the wing, which he means to present to the Linnæan Society, with other rarities. He has got duplicates of most things for me, and is to send them shortly. He has also collected birds, fishes, &c. &c.

I have also received another letter from Dr. Arnold. They encountered a dreadful storm in the Downs, and lost their best bow anchor, put back into the Thames again, and afterwards were driven back by another gale off Scilly to port. He wrote from Kelston in Cornwall. He was making a tour, with Sir Stamford and Lady Raffles, through the mining district, and gives a wonderful account of that interesting country.

Oxford is of all places the most barren of news. Rather than send an empty letter so far, I will give you the only verses I have found time to make lately, which are but the beginning of a subject.

Lines on Staffa.

Ere yet the glowing bards of Eastern tale
Had peopled fairy worlds with beings bright,
Roamed o'er the palace and enchanted vale,
And dreamed a heavenly vision of Delight,
And told of realms rich with unborrowed Light,
On which the needless sunbeams never fell,
Whose noon of splendour never knew the night,
Illumed by lamps that burnt unquenchable,
And dazzling hung in air, upheld by magic spell:

All these and more, with which their wizard strain
Led far away deluded Fancy's child,
Till he would turn on Nature's self again,
And deem her charms a desert bleak and wild,
Himself from visionary heavens exiled;
While yet unheard that strain, the Time had been
When Nature's hand as if in sport she toiled
To build e'en more than could the thoughts of man,
Amid the Ocean vast, had framed a fairy scene.

For she had found a lone and rocky isle,
And at her voice a thousand pillars tall,

She bade uprising lift the massy pile,
And far within she carved a stately hall
Against whose sides the entering waves did fall,
While to their roar the roof gave echo loud—
And she had hid each column's pedestal
Beneath the depths unseen of Ocean's flood,
While towered their heads on high, amid the passing cloud.

And she had fashioned with an artist's pride
The dark black rock where hung the sparkling foam,
And many a step along its sculptured side
Had hewn, as if to tempt some foot to roam,
Some favoured foot of Mortal yet to come.
She bade no shapes of Terror there abound,
That pillar'd hall no guardian dragon's home,
But Ocean rolled his mighty waves around,
To guard from vulgar gaze her fair enchanted ground.

Whatever you may think of the poetry, you will agree with me in regretting that Werner should have died without the knowledge of this geological discovery concerning the origin and formation of basalt.

I am perfectly well, and believe me, my dear father, your affectionate son,

CHARLES LYELL.

CHAPTER III.

JUNE, JULY, 1818.

TOUR ON THE CONTINENT—PARIS—JARDIN DES PLANTES—VERSAILLES—MALMAISON — THÉÂTRE FRANÇAIS — CORNEILLE'S PLAY — PRACTICAL EFFICIENCY OF THE BIBLIOTHÈQUE DU ROI—VISIT TO PÈRE LA CHAISE—THE LOUVRE—JOURNEY CONTINUED TO THE JURA MOUNTAINS—GRAND VIEW OVER SWITZERLAND—CHAMOUNI—GLACIER DE BOSSONS—MER DE GLACE—COUVERCLE, AND LE JARDIN—FLOWERS AND INSECTS—RETURN TO GENEVA—BASLE—HOLBEIN—FALLS OF SCHAFFHAUSEN—LUCERNE—ASCENT OF THE RIGHI.

JOURNAL.

[In 1818 he made a tour in France, Switzerland, and Italy, with his father, mother, and two eldest sisters, and kept a close journal, from which the following extracts are made.]

June 8.—We left Dover and embarked on board the 'King George' packet, and in three hours were landed on the pier at Calais, and the carriage and luggage having been taken to the custom-house, we went to L'Hôtel Dessin. In the morning I mounted the tower, where all the town and sea can be viewed, and then went into the church, the first Catholic one I had ever seen. A painting attributed to Vandyke was shown me, with many others, and images of saints. It was twelve before we left Calais. Four miserable nags were fixed to the carriage, tied on with tackle which any Hampshire wood-stealer would have been ashamed to see round his Forest colts. But the appearance was a small part of the evil: every two miles something (as might have been expected) went wrong. The strong fortifications round each town are of course one of the most striking novelties to an Englishman. Those of Boulogne presented a very different appearance from Calais, the town being

divided into *la haute et basse ville*, the former only being enclosed by walls, and commanding the lower part. English inscriptions over almost every shop pointed out how many of our countrymen were residing there. The different châteaux which we passed between Boulogne and Samer were inhabited chiefly by English officers, and when we arrived at the inn at Samer, we heard a British bugle sound, to rest the horse-artillery, who are quartered there. It seemed that the English had taken quiet possession, both military and civil, of this part of the country.

June 10.—Early in the morning I was roused by the drums and fifes of 400 French soldiers, which passed through Samer on their way from Montreuil to Boulogne. They looked much out of feather, partly from their march perhaps, but partly, as I understood from our soldiers, from their national dirtiness. The scene was much changed when the British horse-artillery were drawn up in the market-place. There were 170 men of these, most of whom wore Waterloo medals, all admirably mounted. Six cannons, each drawn by eight fine horses, and six ammunition waggons, each with four horses, added much to the spectacle. When we had climbed the hill out of Samer, on our way to Montreuil, it was a beautiful sight to look back upon them following in separate corps, each detached body having with them one cannon and one ammunition waggon. They were coming up from the town to exercise near the wood of Montreuil. Going on through a flat chalk country, we passed through the Forest of Crecy, and came on to Abbeville, and having dined, we proceeded to Amiens, and were six hours in going five posts. Clermont was the next fortified town through which we passed. The citadel is on a very commanding rise. Here for the first time we left the chalk (?), which we had been on every step from Calais, and which we entered again before we got to Paris. The country changed with the soil, but not much for the better (with regard to scenery). We slept at Chantilly.

June 12.—In the morning we visited the magnificent stables which belonged to the Palace of the Prince of Condé, destroyed at the Revolution. The exterior is in grand style and good taste. The apartment in the inside which includes

the length of the whole building is 620 feet long, and accommodated for some months 320 horses of the British cavalry, when part of our army were quartered at Chantilly lately. As we drew near Paris small towns began to thicken, as in the neighbourhood of the British capital. St. Denis was the principal place. Here we visited the church, which is very fine. The choir contracts at the east end, much in the style of Canterbury. The heights of Montmartre soon made their appearance after we left St. Denis, and vineyards became common. The road was a straight avenue, with a row of trees on each side all the way, till we entered Paris by the Rue de Clichy, then down Rue Mont Blanc and Rue de la Paix, into the Place Vendôme. Here we saw the splendid column made of the melted cannons taken by Napoleon in his different victories.

We dined at the Hôtel Meurice, Rue St. Honoré, and in the evening drove to Tivoli, a kind of Vauxhall. It was not a full night for these gardens. We tried by way of experiment *les montagnes*, and the whole party descended in these sledges.

Sunday, June 14.—After service at the English chapel, went to the Tuileries. After Mass, Louis came out on the balcony, and was received with what I thought a very cold *Vive le Roi!* We dined at Vérey's, the *restaurateur* in the Palais Royal. The views from his windows of the square filled with people, the avenues of trees, and the flowers, all kept in the highest order, and the fountain in the middle, formed a cheerful scene.

In the evening we drove up the Champs Elysées to the Beaujean Français, something like the gardens of Tivoli, which we had before seen, but on a larger scale, and more crowded, Sunday being the gala-day in France. Different groups were spread over the gardens, some round a band of music, in another place round a conjuror; in another, shooting at a mask with an air-gun was the amusement. Above all towered the Montagnes Français, down which I descended in a car. A balloon went up from these gardens, and the evening closed with fireworks.

June 15.—We visited the Jardin des Plantes, which occupied the greatest part of the morning. The Museum,

particularly the room of fossil remains, amused me greatly. I lamented not being able to hear Cuvier lecture, as he is now in England. The living animals are allowed each a fine space to range in. Martin the bear would not be persuaded to climb his pole. Some time since he had a fall, by which he broke his ankle, or some joint, a sad misfortune to many Englishmen, to whom the sights of Paris must now appear comparatively a blank. We next visited the church of St. Germain, the screen of which is worthy of notice. Capt. Ogilvy [1] called on us early, and informed us that the water-works of Versailles were to play that day in honour of the Duke of Wellington, and invited us to dine with him at his house in St. Germains, the day after. We lost no time in profiting by this intelligence, but set off in a *calèche*. The garden view of the Palace of Versailles is very grand, but it appears to me too large even for a palace, at least in any situation besides the capital. Many thousand people were collected round the large basin of the Dragon, where the Duke of Wellington was to pass. He was dining with some French marshals at the Trianon. At their arrival, with a small body of guards, forty-two immense columns of water rose out of the basin, the great Dragon, with all the dolphins, &c. &c., began to spout out streams of water, and the effect was beautiful.

June 17.—We departed in good time to pay Capt. Ogilvy a visit at St. Germains. The distant view of Paris from this road is interesting. As Malmaison was on this road, we stopped to see it. The house might be that of any country gentleman in England, but derives its interest from having been so long the residence of Josephine, and so often that of Napoleon. There are no pictures of value there, but the great gallery is a fine room, and the full-length picture of Josephine is said to be a good likeness. But I was most delighted in seeing the garden and grounds laid out in the best taste, for though Versailles is a magnificent specimen of art, I confess the sight of winding walks, instead of straight alleys; trees spreading their branches naturally around, instead of being cut and tortured into shape; rose-bushes growing on the ground, instead of being grafted, according

[1] The Hon. William Ogilvy, brother of Lord Airlie.

to the French fashion, and looking like flowers bound on the top of a hop-pole, gave me more of the real charm of a garden than I thought I was ever to experience in France. I understand that the Trianon at Versailles is laid out in this manner, and that the French look upon both as singular curiosities, and have taste enough to admire them. A tulip tree at Malmaison was the first I ever saw in flower. That Englishman who, when he first beheld this tree, and marvelled at the industry of the gardener who had clipped every leaf so evenly with his scissors, would meet in France with enough real instances of labour employed in perverting nature. We saw some very vivid lightning on our return to Paris, but escaped a storm which fell round us. A few glowworms on the bank were the first I had seen in France.

June 18.—In the morning we paid a visit to the Louvre, where, besides the paintings, we had a view of Louis XVIII. setting out for St. Cloud, from the Tuileries. We saw him well, as we looked down into his open carriage, which was drawn by eight horses. We went in the evening to the Opéra Comique. This was the first theatre we had been at in Paris, for besides the heat of the weather, Talma and all the first-rate actors and actresses were away from Paris, at different country theatres. I saw little to admire in the house, and was not Frenchman enough to follow the very rapid pronunciation of French comedians; but the orchestra was good, and music is an universal language. It was the composition of Grétry.

June 19.—We went to the Jardin des Plantes, to see the collection of comparative anatomy, which is very beautiful, and might tempt anyone who had the opportunity of staying in Paris to take up ardently the study of anatomy. There are a vast number of exquisite models, coloured to the life, descriptive of the anatomical structure of the human frame; besides skeletons of a vast number of quadrupeds, birds, fishes, serpents, &c. &c. I afterwards visited the Panorama of London in the Boulevard des Capucins. We dined at Beauvilliard's, a *restaurateur* in the Rue de Richelieu, and afterwards went to the Théâtre Français and heard Corneille's play of 'Le Menteur.' I followed the actors with the help of a book well enough to enjoy it, and laugh

heartily, but often while I was cutting a leaf with my knife, and turning over, I found to my astonishment that they had got down half the next page. 'Le Menteur' is more of a farce than a comedy.

June 20—I went in the morning to the Bibliothèque du Roi, and called for the first volume of Cuvier's work on Fossil Remains, which was immediately brought, as was a French Dictionary and map of France which I asked for. They seem even to take pleasure in waiting on you. The library is of great use, there were six or seven tables full of students, most of them writing. How different in every respect to the Bodleian at Oxford! except in books, in the number of which I suppose it cannot surpass the Bodleian. I read Cuvier's paper on the Geology of the Country round Paris (the chalk basin of Paris).

June 21.—We went this morning to hear Mass performed in Notre Dame. Service was going on in several different parts of the cathedral at the same time. I could neither understand a word they said, nor admire a word they sung; there was no music in the chant, and it was unaccompanied by the organ. A single instrument, a bass-viol, I believe, now and then joined its bass notes with their voices. We next visited the model of the colossal elephant which is to be erected over the canal near the ruins of the ancient Bastille. The idea of this is said to have been entirely Napoleon's. Water is to be conveyed into the animal, and it is to spout it out at its trunk, and thus serve as a gigantic fountain. The taste of this is much disputed, and what the effect will be when the whole is of bronze, and when it stands as a public monument in this city, I will not pretend to anticipate; but the idea is unquestionably no mean one, and the proportions of the model are so good, though above seventy feet in height, that the front view is wonderfully striking. It is done over with plaster of Paris, and has quite the appearance of stone.

We then went to the cemetery of Père la Chaise, a large burying-ground in the same quarter. It would be well worth visiting were it only for the extensive view of Paris which presents itself from this rise. But it has sufficient interest in itself. The immense number of tombstones and monu-

ments, the order and neatness of the walks, and of each little plot round the sepulchres, which are filled with beautiful, and sometimes valuable plants. It would seem here that the cypresses were not—as Byron says,—

> The only constant mourners of the dead,

for we observed wreaths of flowers lately placed on the tombs of some who had departed a long time since. We went in the evening to Les Jardins Ruggieri, which I thought the best of the kind we had visited. But its being Sunday probably added much to the crowds which were there. Sunday in Paris is celebrated like most of the old Roman sacred rites, by dancing as well as prayer. *Le saut de Niagara* is the most conspicuous object in this garden. It is like the other *montagnes*, except that before the car descends it is suspended in the air on a kind of drawbridge, which, like the cross board of a see-saw, is balanced on its centre and loose at the extremities. The declivity down which you are shot is infinitely more rapid than any other in Paris, but very delightful, not only to Parisians. Some splendid fireworks finished the evening.

June 22.—Went to the Jardin des Plantes, where I again looked over Cuvier's lecture-room, filled with fossil remains, among which are three glorious relics of a former world, which have added several new genera to the Mammalia. We also walked over the greenhouses, and admired many fine tropical plants. We had a great treat afterwards at the Opera. 'Le Devin de Village' was first performed, interesting not only from its real merit, but as a literary curiosity, since both the poetry and the music are by Rousseau. 'Le Rossignol' followed, and then the 'Carnival of Venice,' a pantomime, both excellent in their way. The whole was got up with great splendour and magnificence, but a filthy curtain which was let down between the acts could not fail to remind us of that total want of *convenance* which one has so often heard remarked as characteristic of the French. It was like the filthy Stygian pool which flows perpetually down their finest streets.

June 23.—I spent all the day in the Louvre, and became more than ever convinced of how much there is there worthy

of admiring and studying for as many weeks as we had hours to give to it.

June 24.—We drove to the Royal Observatory, and then to the Church or Abbey of Val de Grace, but on entering were astonished to find, instead of the signs of a consecrated place, nothing but enormous piles of blankets and sacks of straw and other things. By a remarkable conversion, it has now become a military storehouse and hospital. I got back to the Louvre in time to spend one hour there before its closing. There I met Sir James Ramsay and Mr. Malcolm, two Oxford friends, who had just arrived from London. In the evening we attended the Opera. The piece was 'Les Danaïdes.' Nothing very striking in the music, still less in the poetry, but all good, and the scenes magnificent, particularly the concluding one of the infernal regions. There were a great number of soldiers about the door, as there are wherever you turn in Paris. They keep excellent order, but bayonets are not very pleasant things to see in a crowd, and the very authoritative tone in which they order about gentlemen's servants and coachmen cannot at all suit an Englishman's feelings.

June 25.—I spent again nearly all the morning in the statue gallery of the Louvre. I was particularly struck with the Demosthenes on the right as you enter the Salle de la Paix, with Venus Genetrix, and many of the Roman emperors, Trajan, Augustus, and a bust of Caracalla. I was much delighted also with Jason stooping to untie his sandal, but more than all with the Fighting Gladiator.

June 26.—We left Paris on our way to Switzerland, in time to reach Fontainebleau, where we slept. In the Forest of Fontainebleau a (limestone) rock bursts up in huge masses through the soil, and presents a very singular appearance, not in any way in character with so tame and flat a country. The timber here is magnificent, of many species and great extent.

June 27.—The exterior of the Palace of Fontainebleau is perfectly inelegant, not to say frightful, and the gardens, if intended for the French taste, very inferior to those of the Tuileries or Versailles, and if meant for English, they are nothing compared to Malmaison. In fact they seem an

absurd attempt to combine these two contrary styles. Garden grounds in France openly profess to display the skill and perfection of art, and have certainly the advantage of show and splendour; but in England they are laid out on the principle of *Artis esse celare Artem*, and to make these two opposites meet in the smallest degree is evidently impracticable. The rooms in the Palace are many of them fine, and the furniture princely. And though the apartments in which the Pope was confined by Napoleon are in themselves nothing peculiar, and still less the small table on which Buonaparte signed his abdication before going to Elba, yet they all serve to remind us of events of History.

June 28.—Through our whole journey from Auxerre to Maison-Neuve there was no single point of interesting scenery, and my only pleasure was from the few passing remarks I was able to make on the geology of this country. It is chalk as far as St. Bris, between which and Vermanton it becomes more like a white limestone, and after leaving Vermanton I observed stratification unlike chalk. At Lucy le Bois it remained much the same, and between this place and Avallon we came upon a blue limestone abounding in Ammonites, some as large as the crown of my hat, some considerably larger, with many gryphites and other shells, continuing to Rouvray. Here the fields are enclosed with hedges, and the country exactly resembled some parts of England. I was astonished at the small village of Rouvray to see the streets paved and the houses built of granite. On our way to Maison-Neuve we found the road cut deep through a red porphyritic granite. Yet there was no change in the scenery, as is usually the case upon entering a portion of primitive country.

June 29.—Upon leaving Maison-Neuve we came again upon the limestone we had left at Rouvray, containing *Cornu Ammonis* and other fossils in abundance. We had to mount a steep limestone hill on leaving Vitteaux. Every here and there were large stones of the colour of ruddle,[2] containing apparently the same fossils as the limestone. At Dijon we slept, the largest place we had been in since Paris.

[2] Or reddle, red iron-chalk.

We passed through Dôle, a pretty town, between this and Vaudray. I saw gravel strewed in large hillocks over the plain, as it is in Scotland. In some small villages near Poligny we were surprised at the change of the buildings, for some were roofed with wooden tiles, and the roofs of some projected a great way over the side of the house, in the Swiss style.

July 1.—The Jura chain rises abruptly from the flat plain. Poligny lies under the mountains, being built on the slope. We had to thank Napoleon for the noble road which carried us by an easy ascent up the precipitous rise of these mountains. Large limestone cliffs presented themselves, the stratification very horizontal. On looking down from the height, we had an extensive view of the plains of Burgundy which we had left. The limestone in the Jura I conclude is of a different age from what we passed through before Dijon, for the latter abounded in organic remains, whereas I could not discover one fossil in the Jura. By the roadside I picked up many beautiful petrifications, which must be forming daily here, where the water is charged plentifully with lime. The minute veins in the leaves of many of these petrifactions were preserved with exactness. I was surprised to see one limestone cliff, which had been cut through to make the road, spotted with dark flints, something like moderate-sized chalk flints, but not in layers as in chalk. Between Champagnole and Maison-Neuve the steep rocks covered with fir-trees reminded us of Dunkeld, and the situation of Morez, where we slept, was at the bottom of a deep valley, where the cliffs and steepness of the rocks on each side, and the large bed of a river at the bottom, formed a romantic scene.

From Morez we ascended to Les Rousses, the frontier town. Here our passports, &c., were examined. We had now climbed to nearly the summit of the Jura. La Dôle was full in view, a mountain that reaches more than 5,000 feet above the level of the sea. It was not many hundred feet above us. On this, and on a few other mountains, small patches of snow were pointed out to us. Now that we had gained the height of the loftiest mountains in Scotland, we could not help reflecting with astonishment on the contrast

between the Grampians and the Jura. Instead of a cold piercing wind, we were here glad of an umbrella to screen us from the heat of the sun; instead of a desolate waste, the dwelling of moor-game alone, here were towns and houses scattered about, and cattle; in place of a boundless expanse of heath, here were tall forests of fir, with the Alpine rose and a thousand beautiful flowers. The *Veratrum* in particular, and *Gentiana lutea*, with their broad leaves, covered the ground in some parts, and gave it, to me, the appearance of garden ground. In descending the Jura from Lavatay to Gex, we had a most magnificent view of a vast extent of country. Below us the Lake of Geneva and the Pays de Vaud, before us the Savoy Alps towering up to the clouds, and, in spite of their great distance and the height on which we stood, extended in a long line before us like an army of giants, Mont Blanc rising high above all in the middle as their chief. We saw the Dent de Midi to the left, shooting up his two remarkable peaks, with many more of extraordinary and picturesque forms. We went to Secheron, and visited Geneva, about half a mile from our hotel. I was rather disappointed in the town itself, but the appearance of the people I thought a great improvement on France. The large spreading straw bonnets are very becoming to the women, and a pretty girl seems not such a rarity in a shop here as in Paris. We crossed a bridge over the Rhone, which flows through the town, coming out of the lake with a rapid current, of a most peculiar deep blue colour. We called on Professor De Candolle, but found he was gone to Paris.

July 4.—We departed from Secheron early on an expedition to the Valley of Chamouni. Geneva we found busy and lively in all parts, it being market-day. A few hundred yards carried us out of the precincts of this republic, and upon entering Savoy, at the small village of Carouge, we underwent the farce of having our baggage examined. We soon passed Mont Salève on our right, and the Voirons on our left, the two nearest hills to Geneva, both calcareous, as is the Môle, a picturesque mountain on all sides, and very verdant up to the top. We passed the Menoge, a small torrent which winds along a deep ravine, apparently the gorge of old of a vast body of water. Here I should have

expected, as in approaching the Primitive country in Scotland, to see large micaceous boulders of the old rocks, but there were scarcely any of the kind. Whether they are buried in the soil, or whether the ruin of the Môle (a large part of which seems evidently to have been torn away) has covered everything. The scenery towards Bonneville, where we dined, and after it, improved at every step. We had been following the Arve for some distance, and after passing through the town of Cluse, we turned with it up a deep valley, or rather an enormous ravine, where the rocks rose to our left to a very precipitous height, and quite perpendicular. Le Brison on the right was a very picturesque mountain.

Le Cascade d'Arpenaz, a fall of 800 feet perpendicular, was looking very beautiful on our left. There was not much water, but the wind carried that little quite away in smoke, before it descended half way, so that farther down, where the scattered spray fell, and collected on a projecting portion of the cliff, a new cascade seemed to spring forth. Our ride was truly romantic the whole way to St. Martin, where we slept. Mont Blanc had been concealed by clouds the whole day, but this evening we enjoyed a full view of him. The setting sun rested on his summit long after it had ceased to light up the valley and neighbouring mountains. Though the outline from here is beautiful, I confess I was disappointed in the near resemblance which it bears to a cloud, for the snow naturally takes the same tints as white vapour from the sun. L'Aiguille de Varens, a calcareous crag which overhangs the village of St. Martin, is of immense height and very grand, especially when half buried in clouds, and the steep rock appearing through them, cut off from its base.

July 5.—Leaving St. Martin, we wound round the Aiguille de Varens, the base of which mountain is partly of slate, partly of schist. The Cascade de Chêne is pretty, but the Chute d'Arve we saw from such a height, that it seemed only a river roaring over a rocky bed. The view from the Pont Pelissier is very delightful. Here we passed the Arve, and soon came in view of the glaciers. After passing the small Glacier of Taconay, the Glacier de Bosson, the most picturesque of all, came in view. It has advanced farther than

any of them in a direct line across the valley, and particularly in the last three years. A fir wood on the farther side marks the spot to which it used to extend before that time. Marching on with its enormous bulk, it has trodden down the tallest pines with as much ease as an elephant could the herbage of a meadow. Some trunks still are seen projecting from the rock of ice, all the heads being embodied in this mass, which shoots out at the top into tall pyramids and pinnacles of ice, of beautiful shapes and of a very pure white, which is finely set off by a background of dark fir. This lower part of the glacier is urged on by an enormous precipice of ice above, descending from the upper parts of the mountain, and which increases in weight every year. It has been pressed on not only through the forest, but over some cultivated fields, which are utterly lost. The poor woman whose land has been thus destroyed, came to present us a petition signed by the minister. They have placed a small wooden cross at the bottom, with the intention, no doubt, of arresting the progress of the evil which threatens to overwhelm many houses immediately before it, and indeed all human power can do nothing else towards saving them.

The Glacier de Bosson marches almost in a straight line, though inclining a little down the valley. There is a declivity before it, all the way to the opposite side, which I think it must reach in less than twenty years, even were it to advance at half the pace of the late three extraordinary winters. Should it ever do so, it must cause a hundredfold the calamity that has just befallen the Valley of Bagne and Martigny, since it would flood the valley above, by stopping the Arve, and then deluge it below when it broke loose. The mischief it has already caused, and the much greater evils which it threatens, must raise in every one a feeling of horror, in spite of the admiration excited by contemplating this picturesque phenomenon. When you walk over the ice you find the air very cold, though a burning sun was warming the valley when we saw it, and causing the vegetation to flourish with luxuriance up to the very foot of the glacier. One of the choicest of our garden shrubs, the Rhododendron, was in flower there.

July 6.—I took a guide early in the morning, and leaving the inn at Chamouni, began to mount l'Aiguille de Brevent, a mountain which rises on the opposite of the valley, and affords the nearest general view of Mont Blanc. It rises steeply, nearly 6,000 feet above the valley, and, as may be supposed, requires some labour to mount, but it well deserves it. Planpraz, a point about two-thirds of the way up, affords a grand view of the summit, and all the points of Mont Blanc, but at every step you ascend, he still rises, till at the top of the Brevent you may consider yourself raised opposite his middle height, the most advantageous station of course. My guide, Joseph Marie Coutet, I found very intelligent. He was the son of one of those who attended Saussure in his famous ascent, had travelled much as a soldier under Napoleon, but was not in the Russian campaign, to which a vast number of the inhabitants of Chamouni were taken, and few ever returned. Yet Buonaparte's policy has augmented the population of Chamouni. By never requiring married men to go, many were driven to this alternative, and as we are told, and might have expected, many very unhappy marriages have been the result. We crossed some large patches of snow in mounting, and found the top of the mountain quite covered, except the highest crag, on which I sat down to eat my dinner. It was the height of luxury in such warm weather to be able to cool my wine by plunging the bottle in snow. The view from this point is truly magnificent. Mont Blanc full in front, with his four largest glaciers descending down his sides—of Bosson, Mer de Glace, Argentière, and Tour; the villages of Servoz and Tour at each extremity of the valley, and Chamouni at our feet, and the river Arve. Behind us rose the snowy summit of Buet, with the Aiguille de Varens, and many others, the Jura in the distance.

In going down the Brevent, my guide chose out as carefully the tracts of snow as he had avoided them in ascending. He had provided me with a pike, tipped with an iron nail, which he used himself. He directed me to lean back on this with one hand, as he did himself on his, and then lock my other arm firm in his. We thus slid down together with amazing rapidity, and precipitous places, that required half

an hour's labour in mounting, were conquered in two or three minutes. It reminded me much of the Parisian amusement of *les montagnes.* This, however, lasted no farther down than Planpraz, which we soon reached, and there I found my father and the ladies, and we descended together to Chamouni. The Rhododendron reddened some of the cliffs, with many other flowers.

July 7.—Having got my breakfast early, I set out a little before six o'clock, with Marie Coutet as a guide, to visit Le Jardin on Mont Blanc. We ascended the Montanvert in less than two hours. I rested a few minutes at Blair's Hut, to look over some of the small collections of specimens of the different rocks of Mont Blanc. The Mer de Glace is by no means a picturesque object from this point. We then had to scramble by a difficult path which leads along the cliff which overhangs the Mer de Glace. The whole of this steep side, covered with the Rhododendron in full flower, was a wonderfully beautiful sight. It was now growing hot, and I was glad to refresh myself with a second breakfast, and some cool water mixed with my wine at the fountain. Hanging from the vaulted roof of the high hollow in the rock, from the bottom of which the fountain bursts, is the *Ranunculus glacialis,* a rare plant. It was in full flower, and a very beautiful and conspicuous ornament, with its white blossom, to the black rock above. It is impossible to climb up to this. A few steps from hence brought us to the place where we were to embark on the Mer de Glace. The first part of this is the most formidable and hazardous of all, and causes many a traveller to relinquish the enterprise. The ice is traversed in every direction by rents and deep fissures, over which you must leap. I could scarcely summon confidence at first, not from any fear of the depth of the chasm, but the unsafe appearance of the landing-place on the opposite side, which, though in fact hard frozen, looks exactly like soft snow, a resemblance which the multitude of small holes in it full of water serves to confirm. In one place a narrow bridge of frozen snow, not above a foot or two deep, leads over a chasm of great depth. This we were obliged to pass.

We had to follow the course of this glacier nine miles up,

but the six last are comparatively easy. I did not find the air so much cooled by the ice as the day before, on the Glacier de Bosson, but this might have arisen from the contrast not being so great with the air I had just left as in the bottom of the valley. I saw, however, that even in July, this large body of ice creates frost enough in the night to encrust over the water which fills many of the chasms. Thus there are but a few months out of twelve that can melt the glaciers at all, and in these not twelve hours perhaps out of twenty-four, and even these twelve hours must in the hottest month be partly occupied in doing over again the work which each night undoes. We had proceeded, I believe, more than half way, before we arrived at what may be considered the river Arveiron, yet unborn. All the meltings of the upper part of the glacier from the summit of Mont Blanc, collect and form a torrent, which confines itself in as correct a bed down the ice as any river does in a plain; and rushing along with great swiftness, it suddenly comes to a deep round well in the ice, just large enough to receive it. It plunges down this and appears no more, till under the name of the Arveiron in the Valley of Chamouni. This chasm is called 'Le Grand Moulin.' As you stand on the opposite side to where the torrent enters, you feel a current of air blow on your face, caused by the water. We saw a rainbow on many sides of this, a phenomenon which I am sorry I did not pay more attention to at the time. It is also wonderful, I think, that since the well is perpendicular, the side against which the water is thrown with great violence, instead of being worn away and hollowed, seems rather to project.

While we were here, an avalanche broke loose from a rock which overhung the Mer de Glace, and came down with a noise like thunder. Many butterflies were flying over the glacier. Every here and there huge boulders of white granite covered the ice. Two in particular, my guide led me to, each of which had one side covered with crystals of quartz, some very perfect and richly charged and coloured with green chlorite. The large space that was covered with these made a splendid show as the sun shone full upon them.

After a walk of nine miles over the ice, it was a wonderful transition, on arriving at the foot of the Couvercle, to sit down on a plot of grass so richly strewed with our blue garden violet that the air was really perfumed. The large Veratrum, blue gentian, and 'Forget-me-not' were in plenty there. Here I took a repast, and seeing my guide fast asleep, I could not resist following his example. After about half an hour he awoke me, and we climbed up a long and steep precipice to the summit of the Couvercle, a projecting rock, which forms part of the lofty Aiguille du Moine. From the foot of this rock you see a valley of ice extend up to the summit of Mont Blanc: around you are all his shapeliest points, ending in beautiful pinnacles of pointed rock. The picture is in short entirely composed of the sublime and terrible—bare rock, ice, snow, and sky, with a dead silence round. The Couvercle is the very seat which the imagination of Virgil chose for the poet Orpheus, when abandoned to despair.

Solus Hyperboreas glacies, Tanaimque nivalem, &c.

Before descending from the Couvercle, I was glad to take a second dinner, for the mountain air has certainly a wonderful effect on the appetite. I observed below me, on the side of the Mer de Glace, a double moraine remarkably regular. The only way in which I can conceive this to have happened, is by the gradual decomposition of two cliffs above, of different altitudes. The fragments from the higher would naturally be thrown out farther, and form the exterior line. The granite sand of the moraine near the head of the glacier contains, as might be expected, much mica, but at the source of the Arveiron, and foot of the Glacier de Bosson, it contains none, but is a white powder and as soft as pounce, consisting probably of quartz and feltzpar, and mostly of the latter. It is this which gives the Arve its milk-white colour, and not, as one often hears said, mere melted snow, than which nothing is more clear, as I was often glad to find when thirsty.

The Arve is much of the colour of streams and ponds on chalk in England, than which nothing can be more unpicturesque, unless perhaps the torrents which rush from

l'Aiguille de Varens when the snow melts in the spring, which my guide assured me are as black as ink, from the slate. We had two miles and a half still to walk before we could reach Le Jardin, a fatiguing addition to the march, since we were up to our knees in snow at almost every step. This little oasis, a small plot of ground only a few hundred yards in circumference, and always surrounded by a glacier, is the highest elevation at which vegetation exists in Europe, but this is not the only reason which renders it worth visiting. You stand on considerably higher ground here than at the Couvercle, and the highest part of Mont Blanc seems to have risen much.

I took a third dinner at this place, and after writing my name on a slip of paper, to put into the wine-bottle there, which is full of names, began to retrace my steps to the Couvercle. I was surprised here at the number of insects, but my guide assured me they were surprisingly diminished since the year 1815. It is only strange they are not completely annihilated at this elevation, since their number has been so sensibly affected all over Europe by the late extraordinary seasons. Many would attribute this to the scarcity of entomologists near the summit of Mont Blanc, but the fact is, I suppose, there are no birds. A flight of hungry swallows would destroy in one evening more than an entomologist in a year.

On the snow which we had to pass between the Couvercle and Le Jardin, I observed that rose-coloured tint which is so difficult to account for, but the snow was not harder in those places, as I had heard affirmed.

I followed my guide with very rapid steps on returning over the Mer de Glace, for I began to be afraid of night overtaking us. The chasms are much easier to leap in descending, since you are always on the higher side, and for the same reason you can leap many which before caused a great detour. We stopped only a few minutes at the Fountain, where, after some pelting, a stone brought down two flowers from *Ranunculus glacialis*. At Blair's Hut I found two English travellers, looking over the collections of rocks. They informed me that my father and the ladies had just left the Hut, and were gone to visit the source of the Arveiron. I

followed them there, by descending the contrary side of the Montanvert to what I had climbed in the morning. This lengthens the return a little. The precipice here is very steep.

There is an album at the Montanvert, which I did not look into, but one of our party discovered in it a stanza which ran, I believe, nearly thus—

> Mont Blanc is the monarch of mountains,
> They crowned him long ago,
> Enthroned in ice, with robes of clouds,
> And diadem of snow—

which, however far from perfection, contains more real poetry than I thought could be found in all the albums of Europe. The blue vault out of which the Arveiron bursts full-grown at its birth is well worth visiting. While we were there, a fine avalanche fell, which we saw and heard to great advantage. The sands of the Arveiron are delicately white and fine, but the grains of gold which they say are found in it must be transferred, like those of the Pactolus, to the poet's verse, before they will serve as ornaments to the scene. The rest of our party rode from thence to Chamouni in chars-à-bancs, but I, though much fatigued, preferred finishing this short distance on foot. The shortest way from Chamouni to Le Jardin and back they reckon forty-eight miles, eighteen being over the Mer de Glace, and five over the Glacier du Jardin. Too much for one day.

July 8.—The number of visitors to the Valley of Chamouni last year they told us was 1,400, 1,000 of whom were English. The town was perfectly inundated while we were there, fifty arrived in one day. We determined to-day on a visit to the Col de Balme, from which there is by far the finest view down the Valley of Chamouni. Chars-à-bancs carried us some way, and mules nearly all the rest, which I was very glad of, as I was very tired from my preceding day's expedition.

The Mer de Glace is advancing terribly every year, but fortunately is going down the valley.[3] The Glacier d'Argentière is perhaps more threatening, from its nearness to the Arve. In the valley I took no less than seven specimens

[3] The Mer de Glace has of late years much diminished.

of that rare insect *Papilio Apollo*. The rock of the Col de Balme is a brown ligneous slate, with some veins of white quartz intersecting it: the appearance is very curious. On the top was the richest carpet of turf I ever saw, spangled with thousands of the deep blue gentian, red trefoil, and other mountain flowers, yet exceedingly level. Farther down quantities of the *Cnicus spinosissimus* made a magnificent show. There is a small lake on the top of the Col de Balme, where we were; but there is still a higher point, with an iron cross at the top, near which M. Eloher perished by his rashness. To this we did not ascend.

July 9.—Left Chamouni on our return to Geneva. The clouds entirely screened the distant mountains, and there were some partial but very heavy showers, which the covering of our chars-à-bancs but ill defended. About Servoz it is extraordinary how abundant the wild barberry grows. At St. Martin we found our carriage again, and dismissed the chars-à-bancs, and Chamouni guides. The latter are a most intelligent set, but the people of this valley are in general frightfully plain, owing chiefly to the goitres, to which the women are more liable than men. At St. Martin there are few in comparison with the great number at Sallanche, on the opposite side of the river. We left Geneva, to commence as it were anew a tour through Switzerland. Coasting along the lake, we passed Coppet, and slept at Rolle, a neat little town on the lake.

July 12.—We entered the Pays de Vaud, and arrived at Lausanne, and walked down to Ouchy, the Piræus of Lausanne, and went out on the lake in a boat. We remarked the blueness of the water, which cannot be owing to the reflection from the sky, since it was very cloudy; nor is it exclusively where the water is deep, for I observed near the shore that the weeds, which when pulled up were perfectly green, were blue when seen through the water. The town of Lausanne is uninteresting, except to us from having been so long the residence of Gibbon. From Iverdun to Neuchâtel is a pleasant drive, but the road at first is execrable along the shingle of the lake, which is of a very sea-green cerulean colour, and very different from the blueness of Geneva. In Neuchâtel there were certainly more good gentlemen's

houses than we had seen in any place of the same size on the Continent. One of Monsieur Pourtalis, in his time the greatest merchant in Europe, whose family still lives here. One of Monsieur Pourri, also a very wealthy merchant. The latter built the large town-hall here, the former the hospital.

July 15.—After leaving Neuchâtel, we soon approached the end of the lake, and went through St. Blaise, a large village, and saw next the Lac de Bienne, in the middle of which is Rousseau's Island, where he resided so long, and by it the 'Isle des Lapins,' which it was his fancy to people with rabbits. We were obliged to have six horses to mount a long and steep hill, from which we enjoyed again a grand view of the distant Alps. A fine mist between us and the base of the chain had exactly the appearance of a second atmosphere, and the gigantic summits of the Alps seemed cut off and unconnected with the earth. Here we took leave of the Alps for a time, and entered a very romantic valley, fine forests of fir on all sides, and high limestone cliffs, the stratification much disturbed, but answering in general one side with the other in their inclination. We passed under Pierre Pertuis, a curious excavated rock, but more celebrated perhaps than it deserves.

July 17.—Went to Basle by the side of the river Birs, up a long valley, in which there was a great variety and abundance of wood. After dinner we walked to the cathedral, and climbed the spire, from which we saw into France, Germany, and Switzerland. I rather liked the effect of the painted tiles on the roof of the cathedral, which were laid in the mosaic style.

July 18.—Holbein was a native of this place, and there are in the Bibliothèque Publique many of his drawings, and nine small, exquisitely finished paintings in the same frame, representing 'The Passion.' They have also here a great treasure, an edition of the 'Laus Stultitiæ' of Erasmus, with pencil vignettes drawn on almost every page by Holbein, and which show a great deal of genius. The collection of fossil remains, taken chiefly from the limestone of the Jura, is rich. I am much struck with some which I believe to have been Tulip Alcionia. They have also a large *Monoculus*, which they consider unique.

We next went to the gardens of Mr. Fisher, banker, which are laid out with taste, and look down upon the Rhine. In the rock-work and arbours were some beautiful specimens of Tuff. This modern formation, which abounds here from the large quantities of limestone in the Jura, is found very useful in building under water, since from its porous nature it hardens every year by deposition. It is also inestimable from its great lightness in the higher storeys of their houses, which are chiefly built of wood.

After a walk round the small botanic garden here, we proceeded on our way to Schaffhausen as far as Stein, a small village on the Rhine, where we slept. The first red sandstone I had seen since I had been on the Continent was in the cathedral of Basle, which is built of it, but I thought I observed it to-day composing the banks of the Rhine.

July 19.—Before the windows of our inn at Stein, on the opposite side of the Rhine, was Säckingen, a considerable town, which, with the two towers of its cathedral, its long bridge finished with a tower, the broad river, and the harvest going on in the fields, formed a pleasing picture. From this place we went on to Lauffenburg, and again crossed the Rhine into Germany. A short distance below the bridge, the Rhine is confined between some rocks, so as to appear only a third of its size. It rushes with amazing violence, the greenness of its colour, the quantities of foam, and the large waves and whirlpools which it causes below these rocks, give it a more exact resemblance to the sea, during a brisk gale, than anything I ever saw inland.

July 20.—When we had approached within a mile and a half of Schaffhausen, we sent on the carriage, and walked down to Lauffen, to see the Fall of the Rhine. This approach is very favourable, and we got many picturesque views of the Fall before we arrived at the Castle of Lauffen. In a room at the top of this, we had a fine front view of this magnificent object. Afterwards they darkened the room, and threw a beautiful landscape of the Fall on a white piece of canvas suspended from the ceiling, by means of a camera-obscura. It was a complete picture, with the addition of motion. The water tumbling over, the clouds of foam, and the agitation of the water in the large basin below, appeared

beautiful on this flat surface. We passed over afterwards to the top gallery, from which you look down on the Fall, and see admirably the contrast of the river before and after it has been hurled down the precipice. We then descended to the lower gallery, where you are well repaid for the wetting you get from the spray. Your eye meets the Fall midway, and you can form a just idea of the body of water which is carried down. The rock is limestone, and I found some fossil shells in it. The masses which break the Fall so picturesquely, are much worn away on the side which is opposed to the current: one is perforated. They must in the course of time gradually waste away. They are happily clothed with underwood. I observed, as the sun shone on the foam, it took very much the rose-coloured tint so remarkable on the snow in the Alps. In our walk back to Schaffhausen, the heat was very oppressive. In consequence of the fineness of the summer, they look forward to as rich a vintage as 1811, the memorable year of the comet. The waiter at the Couronne assured us that at their inn alone they had, in the course of last year, 745 English, not including other foreigners. From Schaffhausen we went to Eglisau, a town on the Rhine, where we slept.

Between Eglisau and Zürich we passed through a very rich corn country. They cultivate much the poppy here for medicine. The flowers are single but large, chiefly white, but sometimes a good proportion of red and pink intermixed. When in full blow, and with a field of ripe corn on each side, it is the gayest crop imaginable. We arrived early at Zürich, and drove to the Hôtel de l'Épée, a celebrated inn, but which I found partook more than any of a fault too common in Switzerland. They have their stables and cow-houses under the same roof, and the unavoidable consequences may be conceived, till they can fall in with a man as able—as 'Hercules to cleanse a stable.'[4]

The next morning we paid a visit to the library, in which, besides many curious fossils, they showed us a literary curiosity interesting to an Englishman, the Latin letters of Lady Jane Grey to some learned man of Zürich, in which were many Greek and Hebrew quotations. From Zürich we pro-

[4] *Hudibras.*

ceeded to climb Mount Albis, from the summit of which we enjoyed a most beautiful and picturesque view of both ends of the Lake of Zürich. On the other side, the Alps were obscured by clouds, but we saw the Righi and the Hackenburg, a very remarkable broken mountain. After dining at the inn near the top of Mount Albis, we passed a small lake which they call the Türler See, and then went down to Zug. The latter part of the descent was almost dangerous for so heavy a carriage as ours.

July 23.—The rest of the party having decided upon going straight from Zug to Lucerne, I engaged a guide to conduct me to the Righi. I landed at Arth, a small place in the centre of Schwytz, where the costume amused me much, for the women wear an exact imitation of the crest of the hoopoo on their heads, a high double frill reaching from the back of the head to the forehead, very ridiculous, and I should think useless.

At the inn an English traveller, a Mr. Hope, who was just sending forward his servant to the top of the Righi, politely offered to engage a room for me at the same time. I then made my guide conduct me to the Valley of Goldau, that I might have a new view of the Rossberg, a mountain from which a large part fell twelve years ago, and buried a village. The guide pointed out very evident marks of a more ancient *éboulement*, which had extended considerably farther than the last, but of which they do not know the date. The recent pile stands exactly over the former one, yet, wonderful to say, a church and a large inn have been erected already over it. A large stripe marks the passage down which the fragments rolled, from the top to the bottom of the mountain. They are chiefly of pudding-stone, and the best explanation I could imagine, after hearing the different accounts of the people there, is that a vast quantity of water, after long rains, had collected at the juncture of the pudding-stone and a stratum of argillaceous earth, about half-way down the mountain, which at length gained strength sufficient to wash out part of the clay, and let down the pudding-stone above. The great difficulty is, that all the accounts of the people there seem to agree in stating that large masses were blown up, as if by volcanic force, perpen-

dicularly in the air, which some attempt to explain by the force of water, others by air, confined.

It was a scorching day, but I proceeded immediately to mount the Righi. About every hundred yards was a high crucifix, with a neat little painting at the top. Numbers of travellers were climbing at the same time.

At Righi, a place about half-way up, where there is an inn, I met with a party of Englishmen, Sir John Wrottesley and his three sons, the oldest of whom is at Oxford, whom I know by sight only, and as intimate with some friends of mine. Having entered into conversation, we ascended by a very fatiguing march to the Staffel, where we dined together. There were a great many fountains of excellent fresh water, which relieved us much the whole way. The mountain appeared composed entirely of pudding-stone, and some very fine cliffs of this rock presented themselves to us in a very singular manner during our ascent. It is a very practicable mule road the whole way, but very laborious.

The view towards the Alps was in part obscured by clouds, and had opened so gradually to us at every step, when we cast our eyes back, that we seemed to see nothing more on this side on arriving at the top, but on looking down the precipice on the western side, which was free from all clouds and mist, a view opened to us which astonished me more agreeably than anything of the kind I had ever seen before. It gave me precisely the idea of being raised to a great height, and looking down upon a whole world at once. Numberless small lakes, rivers, and towns, could be distinctly taken in at the same time by the eye. The large lake of Lucerne, at our feet, happened to have the sun full upon it, and was in a blaze, which at such a depth below us had a singular effect. The lake of Zug also made a great feature in this enormous map. Mount Pilatus seemed of great height, even viewed from this, and the Altorf end of the lake of Lucerne was very remarkable, however much it lost by the distance. As the sun descended, it totally left the lake of Lucerne, and filled with a blaze of splendour the Sempach, which is much more distant, but so considerable a sheet of water, that it became a very striking feature.

We staid on this point till sunset, and then determined

upon mounting to the Culm to sleep, which we found very full of travellers. Fortunately my room was secured, and Mr. Hope came to say he would give also his room to our party, for he should go down the mountain again. In these two rooms were four beds, which was all the landlord said he could spare for our party of five. In this little hut, 4,350 feet above the level of the sea, this Bedlam of languages, this chaos of confusion, were shut up nearly forty travellers, with many guides, and the servants of the inn. Many French, Germans, English, and Swiss, were supping together in the *salle-à-manger*, which was in a few minutes to be a barrack bedroom.

As none of the people of the inn would attend to us, we took possession of two rooms, which contained five beds, but our host turned us out immediately, and said if we were discontented with the accommodation we might turn out of doors, for he had no scarcity of inmates, and for his part he should have thought us well off with half the number of beds, 'since what objection could we have to sleep two in the same bed?' On this dilemma, Mr. Johnson, an Englishman, came to say there were two beds in his room, one of which he should be most happy to give us. We went with him, but found the people taking out this extra bed, and in the meantime some ladies took possession of our single-bedded room. Thus were we reduced to one room with three beds! The landlord, however, soon gave us back our right, and we made up another bed for ourselves on the floor, by pillaging a pillow from one room, a sheet from another, &c. I must not forget, however, the assistance which Mr. Reichenbach afforded us, by coming, when we were nearly in bed, with his bedgown and nightcap on, to beg we would accept *son couverture*, of which he had no want! His large fat figure, which almost out-Falstaffed Falstaff, appeared to such advantage in his nocturnal habiliments, that we could not resist a laugh of admiration, which he very good-humouredly joined in. The eldest of the Mr. Wrottesleys having laid down on this shakedown, I got into a small bed, one of those which our worthy host thought a handsome provision for two of us. I was immediately attacked by a legion of fleas, who seemed to consider me as private pro-

perty. There was too much noise for anyone to get much sleep, and so thin were the partitions, that we heard every one snore distinctly at the distance of three rooms.

July 24.—Before three o'clock, and long before the rising of the sun, nearly forty miserable half-dressed and shivering wretches were to be seen crowding round the crucifix on the highest point of the Righi-Culm. Scarcely a word was spoken, and a stranger might have mistaken them for so many pilgrims, and admired the fortitude with which they bore up against their evident distress. Not a single cloud or mist prevented our seeing the outline of the Alps, and I suppose it must have been our inconvenience (for we were wet through in our feet, as well as chilled by the air) that made our party all agree that the view was less grand by sunrise than sunset. After breakfast we descended to Küssnacht. This side is much more precipitous than the one we had before taken to mount from Arth. A short way above William Tell's chapel is a most delightful view of the lake of Lucerne, Mount Pilatus on the left, and the Stanzerhorn on the right. Went from Küssnacht to Lucerne in a boat with Sir John Wrottesley and his party, and here I rejoined our family.

CHAPTER IV.

JULY–SEPTEMBER, 1818.

MEYRINGEN—THE GIESBACH—GLACIER OF THE RHONE—VIEW FROM THE GRIMSEL—THEORY OF PINK SNOW EXPLAINED—GRINDELWALD GLACIER—LA BELLE BATELIÈRE—AVALANCHE FROM THE EIGER—BERNE—DR. WITTENBACH—THE VALLAIS—DESOLATION FROM THE BURSTING OF THE DRANSE—VAL DE BAGNE—THE BRIDGE OF LOURTIER—CONVENT OF ST. BERNARD—ANCIENT TEMPLE OF JUPITER—BRIEG—THE SIMPLON—LAGO MAGGIORE—MILAN—VERONA—VENICE—BOLOGNA—FLORENCE.

JOURNAL (*continued*).

July 25.—Went in a boat from Lucerne to Alpnach; many magnificent views of Mount Pilatus. The rain detained us some time at Alpnach, and the ladies were obliged at last to set out in a char-à-bancs before it quite stopped, in order to reach Sarnen before night. I preferred walking, and went with my guide by a short cut, which brought me there half an hour before the carriage arrived. We crossed a bridge of wood 500 feet long, but only two or three feet broad, over a torrent which has astonishing power in the spring, but which then, in spite of the showers that morning, had not a drop of water in it. Sarnen is a miserably poor place, yet nevertheless calls itself the capital of the canton of Unterwald. Here they are all Catholics, and Nicholas de Flue is their guardian saint, who for many hundred years has saved their wooden walls from flame. His tomb is not far off, at Sachseln, which we were fortunate in reaching on Sunday, since many pilgrims were offering up their prayers there, some getting down below the floor of the chapel, to pray under his body. The chapel was full of curious offerings, and the variety of the costume of people come from different parts was entertaining. Both the lakes of Sarnen and Lungern are picturesque. At Lungern we dined, and then began to mount the Brunig, a pass

which the ladies found rather nervous on mules, and which I preferred walking. The scenery was very romantic the whole way, till at last we descended into the valley of Hasli to Meyringen.

July 27.—Went from Meyringen to Brientz. We were rowed, and rather rapidly, by two women and a boy. This is a common custom with the women in Switzerland, arising probably from the men all staying for some months in the mountains with their herds. Having landed on the opposite side, we were conducted up to see the different falls of the Giesbach, one above the other, which present numberless views, all extremely picturesque. The body of water is considerable, and very white, and the accompaniments of wood and water beautiful. We returned immediately to Meyringen, and were imprisoned by the rain the first time since our arrival on the Continent. In the morning I visited, in spite of the rain, the Alpbach, a cascade which falls from a considerable height only a few hundred yards from the town. Its colour is a Stygian blackness, and we had heard it all night pitching over, with a horrible clatter, large stones from the top to the bottom. This torrent some years ago nearly washed away the town of Meyringen, after which the inhabitants with great labour built an immense thick stone wall, reaching nearly from the Fall to the Aare, to conduct it in a straight course to the river. Nothing but this saved them on the Saturday before we arrived. The clergyman of the parish had exhorted them, in a sermon on Sunday, to keep a strong guard on the wall night and day, and when the torrent attacked any particular part, to throw branches of fir and other things to divert it from the wall. This guard we found still actively employed, for the river was constantly changing its direction, from the large mass of matter which was moving in its bed. This mischief happens after long droughts, when the sun has had great power on the slate rocks above, and caused them to crack and decompose. None but those who have witnessed it can conceive the strength of water charged with this black slate powder. The rocks seemed actually to float in it, and a trifling depth of it was pushing heavy bodies along.

July 29.—Our party went from Meyringen up the valley

of Hasli to Handeck, to see the Fall of the Aare, the distance of six leagues, a very fair mule road, but which I preferred walking. The Fall of the Aare is truly grand, the height great, and the body of water considerable. Down the same precipice another river of inferior size, but of a better colour, falls over at right angles, and meeting the Aare in the middle of its fall, causes a magnificent conflict of water, with clouds of foam. Two bright rainbows were spanning and connecting with a sort of fairy arch this tremendous rent in the rocks. The Fall is well shown from below, and from the precipices which overhang it, where you are obliged to lie down full length and look over. Here you are placed between the two rivers, the smallest of which was a large body of water when we saw it, from the late rains. Finding here three German-Swiss gentlemen who were going up to the Grimsel, I determined to walk there with them, and see the glacier of the Rhone, while my father and the ladies returned to Meyringen. I had two leagues farther to climb to the Hospice, the scenery becoming at every step more savage. Several times the path crossed large streams by bridges of snow, the remains of spring avalanches, which last all the year, coming down the beds of these torrents, and in many places bridging over the Aare. We passed some extraordinary large bare planks of granite rock above our track, the appearance of which I could not account for. A thick mist afterwards came, which prevented us almost from seeing one another, and I was heartily glad to reach the Hospice, though a dreadfully rough reception one meets with.

July 30.—My feet had suffered so much from my walk of eight leagues over rocky ground the day before, that I left with regret even the wretched bed they gave me at the Grimsel, to undertake eleven leagues more to see the glacier and return to Meyringen. I got, however, on the march with my German friends by five o'clock, though the fog was as thick as it had been the evening before. We could only see three or four feet before us, but when we were on the top of the Grimsel, the guide gave us notice it was going to clear up. We none of us believed him, but it grew more light rapidly every minute, and suddenly the mist which was round us rose above the summit of the Finster Aarhorn, the

loftiest of all this chain of Alps, and is of a very picturesque shape as seen from here. The rest of the vapour fell down upon the little lake which is near the Hospice, and seemed to cross the valley like a compact white body, as a glacier might. The whole of this 'drawing the curtain' did not, I think, take above ten minutes, and was one of the most beautiful phenomena I had witnessed in Switzerland. Soon afterwards we came to a small lake, above which was a steep slanting precipice of glazed snow, a pass which, without pikes, would have been difficult. Here we remarked that bright rose colour on some patches which is so extraordinary. As the guide I had taken from the Hospice could talk nothing but German, I requested my companions to ask each of our guides their opinion on the subject, not with any expectation of their clearing up a difficulty which Saussure could not, but in order to judge of their intelligence. *Their* man, whom they described as *un bon garçon, mais un peu bête*, seriously declared his belief that wine had been spilt over the snow. *My* guide, after having joined in our laugh at this solution, said the cause was evident enough, viz., that when the sun had melted the snow for five or six years, it invariably turned of this colour. We soon came in sight of the glacier of the Rhone, and I was disappointed to see that it was inferior to every one of those of Chamouni in beauty, and the phenomenon comparatively nothing, since instead of the rich cultivation of that at the foot of the Mer de Glace, there were only some poor pastures. I was almost sorry afterwards I had undertaken the task of descending to the source of the Rhone, since it was a precipice which costs much labour to go down and up again. My German friends having gone on to cross the Furka, I returned to the Grimsel to breakfast, and as my guide was of no use, speaking not a word of French, I found my way back to the Fall of the Aare alone, having dismissed him at the Hospice. Here I found Mr. Johnson, whom I had before met on the Righi, and I returned with him to Meyringen.

July 31.—At the inn at Meyringen they keep a boy who is almost an idiot to black the shoes. He can speak but two or three words, and understands scarcely anything but signs. I tried to let him know, by pointing to my watch, that I wished

to be called at half-past three, and, to my astonishment, he came to a minute. I started by five, determined to pass the two Scheidecks before evening, which is fourteen leagues. I had performed the preceding day what the Swiss call eleven *good* leagues, or nearly twelve, and the day before that eight. When I boasted of this to my guide, he observed coolly, or almost I thought with a sneer, 'Oui, c'est assez pour un Monsieur.' A just reproof, and which might come home to many a bragging pedestrian, since, let these gentlemen do what they will, the peasant will follow them as far, carrying their bags, and without the same mental stimulus to assist him. At the foot of the Scheideck I went to see the *lower* fall of the Reichenbach only. In this I saw nothing remarkably fine. At the châlet, which is six miles on, I stopped to breakfast. Many small avalanches fell while I was here, with a noise like that of distant thunder, from the Wetterhorn, which rises here very grandly. A precipice of snow near its summit presents a curious furrowed appearance, from avalanches which have rolled down there. We descended into the valley of Grindelwald, and I went a little out of my way to view the glacier. It is less picturesque, but very unlike those of Chamouni. I had here, as at the Rossberg, another attestation of 'how little distant dangers seem' to most men. The peasant who lives here told me that the glacier advances rapidly, but has not near reached an ancient boundary, for that he had built his châlet on an ancient moraine. If the next three winters are in any way as severe as the last three his habitation will unquestionably form a part of a new moraine. At Grindelwald, where I dined, I saw *La belle Elizabeth*, formerly *La belle batelière* on the lake of Brientz, now the wife of the landlord of the 'Chamouni,' who has the reputation of using her very ill. I bought some trifles of her, to entitle me to write my name in her album, where I found those of hundreds of my countrymen. A remark of Southey's I thought curious. 'R. S. recognises in Elizabeth a striking resemblance to La Fornarina of Raffael.' She has not the least affectation, either in her manner or her dress, and deserves, I think, her great fame for beauty. I did not lose much time in the valley of Grindelwald, with which I was rather disappointed, but climbed the Wengern

Alp, or lesser Scheideck, under a most burning sun. From the top of this the two Eigers are seen to great advantage. The great Eiger rises at once from its base to its summit, one huge and tremendous precipice, far above the height of perpetual snow, but so perpendicular that little can rest upon it. From one of the ledges of snow at about its middle height, I saw a fine avalanche fall over a precipice down to a parallel ledge below. A loud crash announced to us the detaching of the mass, and the leisurely way in which it appeared to our eyes to descend this seemingly short precipice, gave me a vast idea of the height of the whole Eiger. The mass had reached its destination, and a great deal of the cataract of snow which it brought with it had followed, before the report reached us, which was like that of a loud clap of thunder. I was prevented by the clouds from seeing the Jungfrau, but got a fine view into the valley of Lauterbrunnen in descending. There I found the inn so full, that they could not give me a bed after my long march. I was obliged to lie down in the *salle*, with several other travellers, where I got no sleep, not from the want of a bed, for I was tired enough to have slept anywhere, but from the incessant noises. At Thun we met our carriage, and went to Berne through a well-wooded corn country, often much resembling England. Berne was the most regular built town we had been in.

I called with my father on Dr. Wittenbach,[1] with whom we were much pleased. He walked with us on the ramparts, where we got a superb view of the Alps, lighted up by the setting sun. Among other things the Doctor mentioned his having been much enraged with Cox, the tourist, who in his Fauna of Switzerland included the white bear as an inhabitant of the Alps! and as if on Dr. W.'s authority.

In the exhibition at Berne are some good water-colour drawings of scenes in Switzerland, most of them for sale, and dear enough. Here we fell in with Dr. Wittenbach again, and he gave us a most entertaining lecture on the geology and mineralogy of Switzerland. He has a pretty large collection of specimens from many distant parts, as well as the Alps, which he himself has examined carefully. He invited us to bring our whole party to drink tea with him in

[1] Eminent Swiss naturalist.

the evening in a public promenade, which is much the fashion at Berne. We were glad to accept the invitation, and were fortunate in having a fine evening, with all the most distant Alps perfectly clear.

August 7.—We went on to Payerne, through a rich cultivated country. Before descending to this town we saw in the distance the lake of Morat and the opening of the vale of Travers in the Jura. We also passed a small lake before Vevay, containing only a few acres of water. The descent to that place along the side of the lake was most beautiful.

August 8.—From Vevay we went along the shore of the lake, which is much more picturesque here than at the Geneva end. We passed the Château of Clarens to our left, immortalised by the Héloïse of Rousseau, and then came to the Château de Chillon, which Lord Byron has lately made equally celebrated. Here we were conducted down into the dungeon in which the prisoners were confined. Leaving Villeneuve to our right, we passed on to Bex. From the inn we engaged a char-à-bancs which carried us up a valley, branching from Le Vallais, down which we looked full upon the Dent de Midi, a magnificent mountain. The excavations which have been made in hopes of discovering more salt-springs are on a very large scale: galleries of immense length have been cut through the rock. We were not content with walking through the lower one of these, but went up to the higher gallery. The great length, narrowness, and the wet of this, and the wind which blew out our lamps constantly, made it a fatiguing expedition, and we gained little enough by it. Each held a lamp, and the guide one, and all put on some ragged surtouts, to preserve us from the dropping of the water, which gave the party a grotesque appearance in the subterranean chambers which we arrived at in some parts of the gallery. After returning to see the House of Graduation, where the salt is extracted from the weaker spring by a very ingenious contrivance, we got into our char-à-bancs and proceeded towards Bex. From this we went on to St. Maurice, a narrow gorge through which the Rhone passes, and where Le Vallais properly begins, though the valley of the Rhone certainly reaches naturally to the lake of Geneva. There is a large cliff at the right of St.

Maurice, with very horizontal lines of stratification, some of which form terraces. On one of these is placed a house very high up, which seems stuck on to the perpendicular precipice. We went on the Martigny road to the Pisse-vache, a justly celebrated waterfall. Its singularity depends on the distance which it is thrown from the rock where it shoots over at the top, and an appearance of falling rockets which the little jets of water make when they are parted from the main body of the Fall.

After this a scene of lamentable desolation began,[2]—fields of corn under water still, and further on entirely covered with sand. The road was in some places under water, and the carriage was obliged to pass through very deep places. At last we left the old road altogether, and went over a tract of sand, under which had once been hedges and fertile fields. The trees alone remained bursting up through it, and at the foot of each of them was a heap of dried trunks and branches of trees and planks of houses which the current had brought down and lodged there. There was lying by the side of the road one striking instance of the great force which the flood had had. A large pine of full eighteen inches diameter, and proportionable height, had floated down and been stopped by a pollard poplar. The water had rushed with such violence against the two ends of the pine, that it had cracked in the middle and been twisted round the poplar. The tree was green when snapped, and therefore still held together. The diameter was eighteen inches at the part which rested against the poplar where it was broken.

Our inn at Martigny, the post-house, presented a sad scene. The first storey had been filled with mud, sand, rubbish, planks of houses, and boughs of trees. All this had been thrown out into the court. Everything I saw here increased my curiosity to ascend farther up the valley which had suffered by this calamity, and to reach the glacier next day. I found it was necessary to get at least to Sembranchier before night. It was late, but I took a mule and a guide

[2] The Dranse, having been blocked up by the Glacier de Bagne, formed a lake, which burst on June 16 of this year, sweeping away villages, and devastating the fruitful and beautiful valley,

with me, and crossed Mont Chemin. When we got to Sembranchier it was dark as midnight, and a storm of thunder and lightning as terrible as I had ever witnessed. Nevertheless my guide advised me to press on, as there was no rain, to the next place, where there was a better inn, and as we had too much for the next day. It was three miles farther. I determined to walk, and let the guide drive the mule. A little beggar-boy, a child of twelve years old, who I suppose had lost his way and was terrified at the storm, seized hold of the mule's tail, and in spite of the guide's threats clung fast to it, till we got to Bagne, allowing himself to be dragged over stones and through two or three large brooks.

August 10.—The house which I slept at, the residence of President Gard, the chief magistrate for the commonalty of Bagnes, had once been a monastery, and if the accounts of the peasants of this valley can be believed, the French have done the country much good by abolishing it. The monks appear to have been a selfish, luxurious, and despotic body. There are 3,500 souls in the valley of Bagnes; all speak French. Mons. Gard condescends to wait on his guests in character of waiter. He seems popular with the common people, and was chosen, they told me, by the French, as being the only one who could read and write among their 3,500 inhabitants.

At every step as we advanced my guide pointed out some devastations of the Dranse, which I should not have remarked. Many châlets, indeed most of them that stood in the way, have been so completely buried, that a stranger might pass all up this valley, and see no greater signs of desolation than the wide channels Alpine rivers so often present. I had not rode, however, nine miles, before I had feeling assurance of the destructions of the Dranse. The bridge of Lourtier had been carried away two nights before, and only a single plank of the new bridge as yet thrown over. The mule I was of course obliged to leave, and the crossing so furious a river by a single plank would have been dangerous to a nervous person. About eighteen people were employed in erecting this wooden bridge, and I was much amused with the simplicity of their operations. They first cut down three of the largest firs they can find near the

river, square them, and then send two or three men by some bridge, whether up or down the torrent, across to the other side. A rope is thrown over to them, fastened to the end of one of the trees. By this means the first plank forms a communication, after which two more are soon got to the side of it. They then merely fasten cross boards on these three trees, and thus over a river fifty feet wide in the smallest part they can drive hundreds of cattle every day. Large masses of micaceous schist rock have been finely laid open to the day by the late catastrophe. Near the cascade of Lavanche, where the Dranse falls down from a considerable height, the soil has been laid open to a great depth, and it is easy to see that it consists of rounded boulders of an immense number of different primitive rocks, which do not seem to belong to this neighbourhood. The scenery of this valley is very beautiful, like that of Hasli. Owing to the annihilation of the old road, our path was very intricate and difficult, and we had to walk five or six leagues before we arrived at the head of the valley. Here there is a châlet, where six men live who have in charge eighty-four cows and twelve pigs, belonging to perhaps nearly as many proprietors in the valley, who pay them for herding and milking their animals. They make almost all of it into cheese. It is wonderful that six men should be equal to this labour. The heat of the sun was very oppressive, and when I saw an immense fire in the châlet for boiling the milk, I of course felt no inclination to enter. Having got some milk from them, and made a dinner on the provisions I had brought with me, I walked a short way up, which brought us in front of the glacier of Getroz. I was much gratified here by seeing at the first glance exactly how everything must have happened. My guide informed me that this spot was formerly called Mont Mauvoisin, from the near approach of the two perpendicular cliffs on each side of the valley. Opposite to us was Mont Pleureur, a tremendous precipice, over the brow of which peeps the glacier of Getroz, which increased so much in the last severe winter, that it thrust over immense masses of ice. These falling with the snow in the spring, completely blocked up the narrow chasm into which the valley is here contracted. An immense lake was soon collected from the

stoppage of so considerable a river as the Dranse. Every exertion appears to have been made, and two-thirds of the lake successfully drained out. It was the remaining third which had force to lay waste so much land. The remains of this immense avalanche are diminishing greatly every day, but are still a grand object. The perpendicular precipice of ice must be in the middle (to speak within bounds) 150 feet, and the slanting line of snow from the top of this to the side of Mont Pleureur as much again. Between this precipice of ice on the side of Mont Pleureur and Mauvoisin, the cliff on the opposite side of the valley, there is little more than room for the river to pass, and very considerable danger, as every one here believes, of the same calamities recurring next year. There is, however, great hopes, from the heat of the present summer, that the glacier will retire, and the river force its passage as of old, under the spring avalanches. In looking up the valley I saw the glacier of Chermontane, which appears very large. Though there were such numbers of houses destroyed by the flood of June 16, yet only twenty-five persons lost their lives, and those were mostly at Martigny. The engineer had given all due warning, but the people of Martigny thought themselves secure, from a telegraphic communication which they agreed upon with some people at the top of the valley. Fires were to have been lighted as beacons, but those on the two first hills by some mistake were never lighted, and if a shepherd on Mont Chemin, on hearing the roar of the torrent, had not set fire to his beacon, hundreds would have perished. In returning home I stopped to eat some whortleberries, which grow on the side of these mountains of greater height and perfection than I ever saw elsewhere. In this patois they call them Loutres, and use them for a dye.

My guide pointed out to me a dead snake like an adder. Some beetles were feeding on it, which I was amused to find were the *Silpha vespillo* which I have often observed on dead snakes in England. The abundance of grasshoppers and their different notes is really to a stranger a characteristic part of Switzerland's rural curiosities. Some green ones are of an enormous size, and, like Anacreon's, sing chiefly in trees. There is a grey one with scarlet wings

(the colour of the under-wings of *Phalæna Caja*) which makes a curious cackling noise as it flies.

Most of these Grylli, I observed, make their noise by pressing the thigh against their side, but some keep their thighs immovable, and make it with the upper part of their wings and wing-cases. Neither of these organs would make a very poetical figure in Anacreon's elegant ode, as instruments of sound, however much Aristophanes might have enjoyed paying this animal, which the Athenian loved so much, the compliment of having 'a good thigh for singing.'

The bridge of Lourtier, which I had crossed by one plank in the morning, I found nearly finished. Here I mounted my mule, and rode to near Lourtier. The river we saw had increased much by the heat of the day, which had melted much snow. Farther on, we found the road I had passed in the morning was washed away by the swelling torrent. My guide was obliged to ascend the mountains with my mule, and make a detour to Lourtier. I scrambled on, and joined him there. Here, to our further disappointment, we found the bridge we had before crossed in the act of being swept away. The Dranse had brought down rocks which had raised its bed twelve feet or more, just above the bridge. Over these a cascade was pouring, which fell with fury upon the bridge, and had already broke much of it up.

A herd of goats belonging to the different villagers, which I had seen driven over this in the morning, were thus prevented from returning, and many poor wretches went in consequence to bed without their supper, for which they depend solely on their goats. Some men were dismissed to the mountains, to milk them, with a few pails only. The greatest part they said they should be obliged to waste on the rocks, rather than let the goats go two days without being milked, which is very injurious to them.

Since it was now impossible to advance farther, I got a lodging in a miserable châlet belonging to the Frères Michaud, who have lost greatly by the late deluge. They were before reckoned wealthy.

August 11.—I left my hard bed of straw very early, and proceeded to the President Gard's, at five miles distance. We

had to scramble over a difficult mountain path, for the main road on the opposite side of the river was closed from us by the top of the bridge at Lourtier. Having breakfasted here, I went on to Sembranchier. At the hamlet of Matignet, my guide pointed out the place where a barn had been carried away. The widow who had built it, finished it that spring on June 11, and had an inscription carved on one of the boards: 'The widow Anne M. Fillet built this in spite of the lake of Malvoisin.' Five days after came the flood, and this very board with the inscription was picked up at Martigny, nine miles off, and is, I understand, still shown at one of the inns.

In the valley of Sembranchier I was able to ride my mule much pleasanter. There is nothing a Swiss peasant points out with such exultation as a field of corn, nothing is to their eyes so picturesque. The scenery, in fact, of this valley is much hurt by the extent of cultivation, and is in every way inferior to that of the valley of Bagnes. At Liddes I met my mother and sisters returning from St. Pierre. They had not been able to accomplish their visit to St. Bernard, from their fatigue, and at St. Pierre I met my father returning from St. Bernard. When about half an hour's walk from the convent I was overtaken by a most violent hail storm, which drenched me completely and chilled me. I was very glad to accept the offer of some clothes from the monks, who came out most courteously to invite me in. I found three English gentlemen there, and a party of Piedmontese gentlemen and ladies. A very handsome supper was served up at seven o'clock, and the monks made all feel themselves heartily welcome. The worst part of this magnificent institution appears to be the unwholesomeness of the situation. From its elevation the snow rests on it so long, and the walls are made so damp by the meltings in spring, that they are all subject to rheumatism, and it is only the youngest who can remain there at all. They have another convent at Martigny, which receives all the older monks for the remainder of their lives. Those, however, at the Great St. Bernard, seem to be a happy active set, and acquire, of course, a great deal of information, from conversing with travellers from all parts of Europe.

In the time of the Romans there stood a temple of Jupiter where the convent now is, and a number of antiquities have been very recently dug up there. It is the opinion of the monks that Hannibal sent part of his army over here, for (supposing him to have crossed the Rhone at Lyons) he would have fallen in with a Roman station at Vevay, and would from thence of course have been able to learn this communication with Italy. The convent is very far from a handsome pile, but the scenery round it is wild and savage, and reminded me much of the Grimsel, for there is a lake here also. The St. Bernard dogs, so much celebrated for saving people in the snow, are fine handsome animals.

August 12.—Having taken leave of the monks early, I set off in a thick mist, which prevented our seeing anything, in company with the three Englishmen, whom I found very gentlemanlike men. A rock of mica schist which overhangs Sembranchier is decomposing, and peeling in so alarming a manner, that they fear, when the rain follows this excessive heat, that the town will be demolished by an *éboulement* similar to that of the Rossberg. The guides assured us there were enormous cracks traversing parts of the mountain, which had only appeared within a few weeks. We returned to Martigny.

August 13.—From Martigny we proceeded up Le Vallais, in the scenery of which I was much disappointed. We passed Sion; the castle here on a hill is a striking object; when we came opposite to Leuk, I left the carriage, which proceeded on to Turtman with the rest of the party. I had about nine miles to walk from Leuk to the baths where I slept, with the intention of rising very early next morning, and climbing the Gemmi. My walk was in dead silence, for the guide I procured at Leuk, to carry my *sac de nuit*, could speak nothing but German. I found it, however, by no means tedious, for this small valley is beautifully wooded with fir, and the moonlight was exceedingly bright. The Gemmi, from which I expected to enjoy a glorious view of all the highest Alps, was covered with clouds, and rain had been falling on it. I determined, therefore, to give up the expense and trouble of this arduous enterprise, and content

myself with seeing the baths. The company at these was not particularly numerous at this season, but it is a curious sight in the large room. I visited some of the smaller hot springs, and a small waterfall about half an hour's walk higher up than the village. On my return I found my father, who had rode up there from Turtman, to which place we returned together, and joined the ladies, and went on in the carriage to Brieg. We passed at Visp the opening of a valley, down which comes an immense river from Monte Rosa and meets the Rhone. The barberry-bush, which grows abundantly wild here, is a beautiful shrub.

August 15.—The first view we had of Brieg was singular, and rather picturesque, from the multitude of towers. A Jesuits' college is just re-establishing itself here. From Brieg we began to mount the Simplon, and were obliged to take eight horses throughout the ascent, which is, however, quite unnecessary. In mounting one enjoys extensive views back into Le Vallais, but nothing very grand for Switzerland. The descent, on the contrary, on the Italian side, was something new, and very magnificent. It is one of those valleys or deep ravines so common on the sides of smaller mountains in Scotland, but magnified to a size which makes it worthy of Monte Rosa. This road is a wonderful work of Napoleon's, and shows the skill of the French engineers. The labour of the galleries, which are blown with gunpowder through granite, must have been immense. This road now belongs to the government of Le Vallais, and must be valuable to them, since so many of their people are thus kept in employ, and paid by the numerous travellers, chiefly English. We paid, I think, 26 shillings at the barrier. The road cannot be in better order. We left Le Vallais at Isella, and entered Piedmont, and went on to Domo d'Ossola. The difference of the Italian side of the Alps is as remarkable as that of the southern side of a garden wall. Houses and fruit-trees reach to an extraordinary height up the mountains, and the crops of tall maize and hemp make a great show in the valley. Domo d'Ossola is prettily situated. Here you take leave of the mountains, which are by no means finished by the descent from the Simplon. We never saw the very summit of Monte Rosa, because of the clouds,

but from what we did, I should conceive it not to be a grand mountain for its enormous height.

August 16.—We were fortunate in entering Italy when the great heat had ceased, which we learned had been excessive everywhere. We embarked on the Lago Maggiore at Feriola, and were rowed to Arona, having sent round the carriage, visited the Borromean Islands, which are so celebrated, that all are disappointed with them. They would, however, be pretty enough, if the buildings on them were not so frightful. The large ugly palace on Isola Bella is so out of proportion, that the little islet looks as if it would sink to the bottom with its weight. In the interior, however, it is a handsome nobleman's place. In the gardens here we saw a fine American aloe in flower, and two bays of extraordinary size. They both spring from the same root, are 105 feet in height, being nearly equal each, and 10 feet in circumference each, measured 5 feet from the ground. Arona we found a delightful little place. Near this we saw at a distance the colossal statue of San Carlo Borromeo. The Italian lakes are much more cheerful than those of Switzerland, from the quantity of houses, wood, and boats, which latter are sadly deficient on the Swiss lakes.

August 17.—Went on to Sesto Calende, which stands at the end of the Lago Maggiore. Here the carriage crossed the Ticino, in a ferry boat, and we entered Lombardy. From thence to Milan is a richly cultivated country. The Indian corn, of which the quantity is extraordinary, stands from ten to twelve feet high. The hemp is very tall, and the vines, which are festooned on low trees (chiefly mulberries I believe), form elegant partitions to the fields. The flat on which Milan stands is so dead, that you see scarcely anything of the town till you are in it. The avenues round it, made by the French, are planted chiefly with the *Bignonia catalpa*, a singular and elegant tree. The lines of pavement in the streets of Milan, for the wheels of carriages to run on, is a refinement which was new to us, and deserves imitation. It must save carriages amazingly, for they glide along with delightful ease and swiftness, and make no noise. We went to the Hotel d'Italie.

August 19.—Went to the Brera, once a convent, now

converted into a picture gallery. A valuable painting of Raphael in his first style, and of Perugino his master. Attached to this is a small botanic garden, which has some good things in it. We then went to the amphitheatre which Buonaparte built, capable of containing 50,000 spectators, in which was exhibited chariot races, &c., and water could be introduced for the Naumachia. The Austrian soldiers now use it to learn to swim in.

The famous fresco of Leonardo da Vinci, 'The Last Supper,' is still fine, much as it has suffered. The French made a stable of the room of the old convent which contains it, and the damp would shortly have destroyed it, had not Beauharnais heard of it. The triumphal arch of the Simplon is the finest work of Napoleon's I have seen. It is of beautiful white marble, and the sculpture and designs of the alto-relievos are fine. It stands, unfortunately, unfinished, though, had it not been so, the Austrians might perhaps have pulled it to the ground, since some fine friezes which were prepared related to Buonaparte's victories over them. The Emperor of Austria can feel no inclination to go on with this trophy, and the expense would be great, since what is prepared it would be unnatural and unpolite to erect.

There is in a street of Milan a fine ancient colonnade of fluted pillars, said to have belonged to a palace of Nero's. There is another triumphal arch of Buonaparte's to commemorate the battle of Marengo, which is not remarkable. The Austrians have erased his inscription, and in its stead have inscribed 'Paci Populorum Sospitæ.'

August 20.—We drove about the town of Milan over the delightful pavement of these streets. There are no very fine squares in the town, except the opening opposite the cathedral. The white marble loses much of its effect, from the darkness of the bottom part, which has been long built, and beautiful as each of the numberless sculptured pinnacles are in themselves, the whole building is not grand. When you stand on the roof, the *coup d'œil* of the ranks of pinnacles, each bearing a statue, is very beautiful. From the top of the tower we had a fine view of the town, and the vast plain of Lombardy bounded by the Alps and the Apennines. The view of the mountains was not clear.

We then went to the Mint. The merchants have just struck off many thousand gold coins with Napoleon's head, dated 1814. The Ambrosian Library, which we visited, contains the Virgil of Petrarch, which it is said he wasted his time in writing himself.

We went to the Opera in the evening, which is a much larger theatre than that in London, but much inferior in beauty. The dancing I thought superior to the music.

August 21.—We paid a visit to the Observatory; the air was clear, and Monte Rosa looked grand from his enormous height, though his outline was not good. It is a very near resemblance to the Blumlis Alp, as seen from Thun.

I was interested in seeing through a telescope one of the spots on the sun. In the evening we went on to Brescia, through a richly cultivated plain, where irrigation was carried to beautiful perfection. Streams often crossed the road, which passed at right angles over others by small aqueducts.

August 22.—Brescia is an immense place. We visited several churches, in which are some pictures by the old masters; Titian, and others.

We afterwards went on to Verona. The vines are beautifully festooned on the trees, and the grapes purple. The amphitheatre here was the grandest Roman antiquity I had ever seen. The marble of which the innumerable tiers of steps are built is uninjured. Fortunately, one small portion of the outer *façade* still stands to point out its ancient height and magnificence. This enormous building serves now for a stage to mountebanks and conjurors, who when we entered were amusing a crowd, which seemed actually lost in one of the corners of this immense oval. Such sports may at first sight appear a degradation to this glorious relic, but what were those which once drew a Roman audience there?

I must not forget that between Brescia and Verona we passed the beautiful lake of Garda, Virgil's Benacus, and the fortress of Peschiera. We only skirted the lake, but could we have gone up it, the scenery promised to be beautiful. It is not much inferior in size to any lake in Italy. There is a large Roman arch of triumph by which

we entered Verona. The antiquities are the principal magnificence of this large place. The Cathedral has nothing to recommend it but an Assumption of the Virgin by Titian. From Verona we went on through a country resembling a rich garden. The hedges even by the road-side sometimes festooned with vines, and besides the Indian corn, another enormous grass of similar growth and height, and even more handsome, is much grown. It yields a grain which they give to animals, and make brushes of the heads. They call it Sciorgo rosso (*Holcus Sorghum*[3]). We stopped some hours at Vicenza to admire the beautiful architecture displayed in the palaces and public buildings built by Palladio. Vicenza was his birthplace, and we were shown the house which he once inhabited. He has raised here to his memory a most interesting classic treasure: a theatre, taken from plans of Vitruvius, which may be considered as an exact model of what the ancients used for their theatrical exhibitions. Though a small model of an ancient theatre, it would be considered a good-sized modern one, and strikes one immediately as extremely elegant and chaste in proportion and decorations.

In some of the churches here are pictures by masters of the Venetian School: Paul Veronese, Bassano, and Bellini. We afterwards went on to Padua. Passed some fields of rice, which before I had never heard was grown in Italy. It grew dark before we reached Padua, and I was delighted at seeing several (*Fulgoreæ*,) fire-flies, resting on the willows by the side of our road; some were on the wing. Their light almost rivalled that of our glow-worm, but only appears at intervals as they fly, the wings I suppose covering it each time they strike.

August 24.—At Padua we walked to the Hall of Justice, an enormous but not handsome room. An inscription here reminded us that the great historian Livy was born here (Patavinæ). Here we met again Sir J. Wrottesley and his sons, who were going on to Venice. They told us that the day before, a courier on his way from Milan to Venice with 40,000 francs had been robbed near Brescia. A soldier who accompanied him as a guard was shot dead by the robbers, and he himself was nearly beaten to death. From Padua

[3] Millet.

we travelled on to the sea-side and embarked at Fucina for Venice, in a boat which makes part of the regular post. The distant view we got from the lagunes, of Venice, made our hopes of its magnificence fall considerably, as did the entrance by a narrow street, but they were soon raised again to their full, on entering the Grand Canal. We were rowed up through crowds of gondolas to the Hôtel Grand Bretagne.

We arrived in good time at Venice, and went out the same evening in a gondola to St. Mark's Piazza. This beautiful square is not to my mind much ornamented by the great square tower. Being of red brick and with a green cap, and with a line of small apertures running unequally down one side, the effect of it is not in harmony with the beautiful regularity of the rest, however well in some pictures this is concealed and softened down by alterations of the colours. The form of St. Mark's, which is a copy of that of St. Sophia's at Constantinople, is very cheerful and gay, consisting of one large dome surrounded by four smaller ones. This closes beautifully one side of the piazza, and opposite to it is a new palace which Buonaparte built, having destroyed, to make room for it, a church and buildings which were before a more picturesque finish to that end of the square. This is a change much to be lamented.

In the bronze horses of Lysippus which stand in front of the great dome of St. Mark's, being raised not too high to have a fine effect from below, I confess I was somewhat disappointed. The heads are fine certainly. It is the fashion now to complain that these four steeds are thrown away, from being placed where they are not to be seen from their height, but travellers have only to take the small trouble of ascending by an easy staircase, and they may see them near. Le Place Petit St. Mark is also exceedingly beautiful, and gay from the crowds of gondolas, and the fine width of the Jews' Canal, and the churches and buildings which come in view there. La Douane, St. Mark, and St. Giorgio were conspicuous. There was a true Italian glow in the sky, which gave a colour to the buildings highly favourable. But if this scene is now so fine, what must it have been when Venice could boast the empire of the sea, and saw at this

spot vessels from every country of Europe pour in commerce.

August 25.—From our windows we had a delightful view of the Rialto and the Great Canal. Early in the morning it was very beautiful to see the boat-loads of fruit, particularly of the most immense pumpkins, each single one almost too heavy to be lifted. The gondoliers stand universally as they row, as is the custom on the Italian lakes and some of the Swiss. This practice gives astonishing life to the scene, and the motion is remarkably elegant.

We went out in good time, and visited many of their splendid churches. In the Chiesa dei Gesuiti (Santa Maria del Rosario) the altar is ornamented with small pillars of lapis lazuli of great value, built by Marsari. The architecture is very chaste and elegant both within and without. We next saw the Chiesa del Redentore; then to the large church of Santa Maria della Salute. In this, three very fine specimens of Giordano's are to be seen, three large pictures representing the Nativity, Presentation, and Assumption of the Virgin. We then saw the church of San Giorgio Maggiore, and from thence to St. Mark's Piazza. Here we entered the Doge's Palace.

The room of the Grand Council must fill every one with vast ideas of the ancient power and magnificence of this Republic. Of great size, yet elegant proportion, the ceiling rich with gold and innumerable paintings by Giulio Romano. Statues down the middle of the apartment, and at the sides large and grand works of the two Bassanos. At the end where you enter is an enormous Paradise of Tintoret, containing a truly innumerable quantity of figures, yet so arranged as to produce a good effect. This is the largest painting in oils, they told us, in Italy. We entered afterwards St. Mark's Church; the whole ceiling there, of the five domes, is in mosaic, and executed after the designs of some of the first masters of the Venetian school. The pavement, which is done something in the same way, has large hollows in it in some parts, and is very uneven, the piles on which its whole weight is supported having given way here and there. We went up, after admiring the riches of the altar, to the gallery, where we saw close the horses of

Lysippus, and had a view down into the square. In this church are several trophies brought both from Jerusalem and Constantinople after the Crusades; pillars, statues, &c. In the evening went out to see the most wealthy of all the churches we had yet seen: Santa Theresa, built by eight noble Venetian families; there are in it six most magnificent altars, rich with rare marbles, precious stones, &c. &c.

On our way to this church we passed under the Rialto; it is an exceedingly fine arch, but the shops upon it certainly injure the effect much. All the fine things of Venice lie very commodiously near one another, at least the rapidity of the gondolas makes them appear so. It was growing late, but we determined on visiting the gardens which the French made; the only thing of the kind in Venice. They pulled down a church and several convents and other buildings, the ruins of which raised the soil higher than almost any other point in Venice; on this they planted avenues of trees, and made handsome walks, which are laid out certainly with taste, and in a good style, and look already very handsome.

In our way to this we passed Lord Byron's gondola, who was returning from the Lido, a small narrow strip of land which is near to the continent, and faces Venice. It is an island, and the only place near Venice where a ride can be obtained. On this Lord Byron has built stables, and keeps a stud of six horses. After breakfasting at ten o'clock, he is rowed in his gondola regularly almost every day to this island, where he rides six miles out and six back again. He then returns—is generally alone in these excursions. His residence was in one of the old palaces not far from our hotel.

August 26.—We visited a most superb room built by a fraternity of merchants in Venice, in which all the pictures were by Tintoret, many exceedingly beautiful. The effect of this hall is very striking, and impresses one with the riches which commerce can give the smallest state, and at the same time with considerable admiration, that the taste of men employed so much in business should have risen so much beyond what is usual in such persons.

After returning to our hotel and dining, we again took a gondola, and went to see 'The Martyrdom of St. Peter,'

Titian's *chef d'œuvre*[4] in the eyes of artists, at the church of St. Jean et Paul. As the evening was delightfully mild, we made them row us all round the large naval arsenal, from which once were launched such powerful fleets, and round the new garden, thus making a complete circuit of that side of Venice.

We spent almost the whole morning in the magnificent gallery of pictures belonging to Count Manfrini, in the Manfrini Palace. This it seems is the most splendid collection in the possession of any individual at this time in Italy, made by the late Count, since the French Revolution; a man who rose by farming tobacco at an immense extent, from beggarism to enormous affluence. He purchased a title, which is easily procured by money at Venice, and had the taste to select a most choice set of specimens of almost all the great masters. To study these would have required weeks of course, but the things which made the chief impression upon me during the few hours we were there, were a Queen of Cyprus by Titian, a very beautiful portrait, and a portrait of a man by Rembrandt, the most astonishing production I ever saw of his.

After spending the morning here we left Venice, and after crossing the water, went on to Padua. In this town we had before left much unseen. Everyone should visit the church of St. Antoine here. It is most extraordinary that of the sculptures in relievo in the chapel of the patron saint, in which the different miracles are represented, no less than four were *raising from the dead*; so that in this, the farthest stretch of miraculous power in suspending the laws of nature, they believe St. Anthony to have done more than is recorded of Christ himself.

The chapel of this saint is full of votive pictures which attest miracles performed since his death. While we were looking at one of the offerings, our cicerone, a man who belonged to the church, said, 'This, sir, is a miracle I saw with my own eyes; the child had a deformed leg, and upon the mother praying earnestly at the shrine of St. Anthony, it was restored to her whole as the other.'

From the manner in which the man related this, it ap-

[4] Since destroyed by fire.

peared to me that he believed what he was saying, to such an extent does their superstition extend! The greater part however of the votive tablets relate not to miracles, but providential escapes from imminent dangers. As all these are most religiously attributed to the guardian saint, it is easy to perceive how perpetually his influence is kept alive. But everyone who has looked over in a cursory manner the collections of votive tablets which in almost every church he meets with, must be struck at the vast proportion which *being run over by carriages* bears among the accidents. The careless and extremely swift pace which is so much the fashion here in driving through towns, and the great number of carriages, easily account for this.

The Botanic Garden here is worth visiting, as indeed must every Botanic Garden be in Italy, where our greenhouse and hot-house plants flourish as if in their native climate, though in winter here they are obliged to protect them most carefully from the severe cold. A fine sugar-cane here was interesting, and an immense fan-palm tree, which the gardener informed me, to my great surprise, is wild in Spain; also fine Banyan trees, *Laurus camphora*, &c.

August 28.—From Padua we proceeded on to Ferrara, through a vast plain. The castle and fortifications of Monselice make a show in this flat country, standing on a small rising. Near Rovigo we crossed the Adige in a ferry boat, by which the carriage also was transported. This river, as indeed are most of those both small and great in this plain, is of a most formidable height above the plain. The deposition of earth which they bring from the mountains raising their beds continually, and the inhabitants being obliged to bank them in strongly for fear of a deluge.

In the plain of Lombardy there is a remarkable scarcity of houses between the great towns; indeed one never sees a building, and wonders where the farmer's necessary offices are in so richly cultivated a country. In return for this, towns of immense size are met with at every step. Ferrara is one of them, and of 22,000(?) inhabitants, yet covers more ground even than is necessary for this, from the porticoes on each side of nearly all the streets. We visited the Cathedral here, and afterwards the Library, in which is the tomb

of Ariosto, who was a native of this town. The inscription consists of some common-place complimentary Latin verses.

From Ferrara to Bologna is a continuation of the same dead flat which we had been on ever since we entered Italy, but here we in a great measure lost its amazing fertility. We were delighted while dining at the inn with some street music, which was a great treat. The band consisted of seven blind men, who had all studied in the South of Italy, though they were originally from Bologna. There were violins, violoncello, clarionet, &c. &c., and also a respectable female singer, wife to one of them, who relieved the instrumental performance now and then. It is their custom to play always on the arrival of any English at dinner every day.

Some of the finest works of the great masters of the school of Bologna have been lately restored to their native town from the Louvre. They do not mean to attempt to replace them in their former stations, but are putting them up in a large public room, in which I think they will stand certainly a better chance of being seen well than in most churches, where huge candles, &c. are posted before them. But we were in luck to arrive there before this new arrangement was quite finished, since most of these immense works were on the ground, resting against the wall, by which means we saw them at whatever distance we chose; whereas I fear some few of them will by-and-by be lifted up much too high. In a grand picture of Domenichino's, 'The Massacre of the Christians by the Albigenses,' some of the female heads delighted me exceedingly, but the painter, to preserve their beauty, has certainly suppressed all the horror which they ought to be feeling.

August 30.—We hired a calèche and drove about the town to the different palaces. At Casa Ratta was the famous Sybil of Domenichino's, a spirited head. This is to be sold, as are many of the fine things in private collections. Some have been already bought at great prices by the English, and have left this town. There is great appearance of poverty in Casa Ratta.

August 31.—We left Bologna and began to mount the Apennines. The view back upon the town was not

so fine as one we had enjoyed the evening before from a small rising on which stands the prison. It must however always be a fine object, and the hanging (or leaning) towers a most singular feature. As soon as we began to ascend, they harnessed on four oxen before our four horses, which was to us a perfectly new style. We crossed a river soon after Bologna, which is very destructive sometimes, but in a valley which we looked down into on our right hand during most of the ascent, we saw the Reno, the most desolating stream I ever saw, though the waste of land here is I have no doubt owing to the crumbling and decomposing nature of the sandstone of which the mountains here are composed, and from which accident they give a very peculiar and extraordinary character to the scenery on this side of the Apennines. For the superstratum of the soil has been completely washed away, and no vegetation remains excepting the trees, which are abundant; between these is seen the white bare sand, and here and there a larger space perfectly white, so that the surface as far as the horizon both ways is chequered with green and white.

After mounting some miles, we had a very extensive view back on the vast plain we had left, which seemed as level as the ocean, and indeed is very nearly so. They say moreover that from hence on a clear day one can discern the sea in the distance, but this I should think without a telescope must be always impossible. We saw on all sides very extensive forests of sweet chestnuts, which from its foliage, and the contrast in the colour of the fruit, which was in profusion, was a very picturesque tree.

As soon as we left the sandstone, and came upon the limestone hills, the curious character of the scenery ceased. We entered Tuscany; the officers of the Douane, quieted by a fee, let us pass unmolested, as they will everywhere in Italy. We proceeded on to Coviliajo, a small town where we slept, having passed a volcanic fire which proceeds from a mountain a few miles from here, intending to visit it at leisure on our return over these mountains.

September 1.—The rocks about Coviliajo are principally basaltic, which agrees well with the volcanic fire in this neighbourhood; indeed the steep whin cliffs which here and

there burst up strike the eye immediately as not belonging to the tame limestone hills which form the chief character of the chain.

Throughout the first part of the day the scenery was wild and picturesque; on descending the Florence side, it became rich and fertile: the hills covered with the sweet chestnut, vines, and quantities of olives; the gardens full of standard peaches, &c.; the grounds about the numerous country-seats abounding in the cypress and the *Pinus pinea*. All these, with a clear sky glowing with heat, presented for the first time to our eyes a characteristic Italian landscape.

The entrance to Florence is fine, from the public walks and triumphal arch. We drove to Sneider's Hotel, which is famed as being the first in Europe. Its situation and magnificence, joined to the real comfort in it, entitle it to its reputation. It is nearly monopolised by English families all the year.

September 2.—The attacks made upon the rich purses of the English, of which foreigners have certainly formed vast ideas, are almost more numerous at Florence than at Paris. The first thing in the morning, at breakfast, arrived a letter celebrating both in verse and prose, both in English, Italian, and French, 'the auspicious arrival of Sir Lyell and his illustrious family.' After celebrating the wealth and naval power of England, the poet hoped 'to share in the fruits of the unbounded generosity of the English.' All the production was execrably bad, and we were sorry to find, when the author called in person, that he was too old to be amusing as a fool. We made him however recite to us the verses, of the merit of which he entertained evidently very different opinions from us.

After this son of Apollo, came a statuary with alabaster figures; then a sort of gentleman-beggar with elegant bouquets of flowers, with which he begged to present the ladies; then a print-seller, which finished the morning's assault, at least as far as we know, for we drove out to the Pitti Palace, belonging to the Grand Duke of Tuscany. Here there is a magnificent gallery of pictures. The first that arrested our attention, were two large landscapes by Rubens, of great beauty. The first they called 'Going to Market,'

the second 'a View in some Part of Spain,' in which the bright gleams of sunshine and dark shade, so often seen in nature, when in the day-time there is a high wind and many clouds, was expressed very finely. There was a picture of Michael Angelo, 'The three Fates,' which I did not think anything surprising. The celebrated 'Vierge à la Chaise' of Raphael has been newly framed, and a glass put over it. We stopped some time to admire two other grand productions of Raphael, the portrait of Pope Julius II., and St. Catharine and Holy Family. The suite of rooms in this Palace, now the residence of the present Grand Duke, brother to the Emperor of Austria, is very princely, and in high preservation.

After satiating our eyes with pictures, we went to the Great Gallery of Medicis, where we might study some of the first statues of antiquity. In the Salle de Niobe, to begin with herself, I thought the grief in her countenance, though not perhaps equal to what it would be in nature, yet greater than I ever saw in any statue or picture.

As a group, the effect is much lessened I thought by Niobe's being colossal and her daughter of the natural size. The statues of her sons and daughters which were round the room are some inferior, but one or two of them exquisite.

From this room we went into the Tribune, an apartment where all the most precious morsels both of painting and sculpture are collected together. Here stands once more the celebrated Venus de Medici, and it equalled all my expectations, which I am well aware it does to few. It appears to me that in statuary those who know nothing of the art are much better able to enter fully into the merits of the first works in it than they can in painting.

[Here the journal ceases, for the note-book containing the remainder is supposed to be one which was lost at Florence.]

CHAPTER V.

SEPTEMBER 1820—JULY 1823.

LETTER FROM ROME—IMPRESSIONS OF THE FORUM—POLITICAL DISCONTENT AT NAPLES—GEOLOGICAL ANNIVERSARY DINNER — GEOLOGISING IN SURREY—VISIT TO ROMNEY MARSH—GEOLOGY OF THE ISLE OF WIGHT —GEOLOGICAL CLUB DINNER—PARIS—SOIRÉE AT CUVIER'S—ALEXANDER VON HUMBOLDT—LA PLACE—ARAGO—POLITICS—ALIMENTS FOR EVER.

[In 1819 Mr. Lyell took the degree of B.A., obtaining a second class in classical honours. He became M.A. in 1821. In March 1819 he became a Fellow of the Geological Society of London, and also of the Linnæan Society.

After leaving Oxford he was entered at Lincoln's Inn, and resided in London, and studied law in a special pleader's office (Pattison's). His eyes, however, became very weak, and he was recommended to desist from reading for a time, and to join his father in a tour abroad as far as Rome in the autumn of 1820; he had then no time to devote to geology, as they were busy seeing the towns, pictures, and natural scenery.

In 1822 he made an excursion to Winchelsea for the purpose of inspecting Romney Marsh, an extensive tract of land, from which the sea has retired within comparatively recent times.]

CORRESPONDENCE.

To His Sister.

Rome: September 28, 1820.

Dear Marianne,—You will expect me to be very full in writing to you from this city. I must tell you, however, that there is only one thing which has gone very far beyond my expectations, and that is the statues of the Vatican. I had no idea that half so many exquisite productions of Greece and Rome were still in existence. Mathews, in the

'Diary of an Invalid,' says that you must not look for beauty in the remains of antiquity in Italy, for none of the ruins here are so picturesque as those of our own Gothic abbeys in England. This is most true; but he goes on to say, it is from the great names they are connected with that they become more interesting than ours. Here I must differ from him, for if they contain so little now to admire in them, how can they assist our imagination? I always had a grand idea when reading the classics of what the Roman Forum and Capitol once were, but now I shall always find great difficulty after seeing what it now is to raise again half so good a picture in my mind. The Forum now is about half the size of Grosvenor Square, the surface uneven from large mounds of earth thrown up from excavations, and looking like large dung-middens overgrown with weeds. Down the centre is a double row of half-starved, shabby elm trees; round it the celebrated arches of Septimus, Titus, and Constantine, each standing more than knee-deep in a large pit! for the soil has risen everywhere at Rome in an almost unaccountable manner, sometimes 40 feet from the ruins of buildings shaken down by earthquakes, and, before an ancient arch or pillar can be shown, a gulf must be made round it. At almost every ancient relic I have had to say 'Amen' to Forsyth's exclamation, 'Those lying engravers!' The Colosseum, however, from its immensity defies exaggeration. As for the seven hills of Rome they have been swallowed up by earthquakes I suppose, for Ludgate Hill would match any of them that remain. The Romans used brick for their finest buildings, and then covered walls 20 or 30 feet thick with a facing of stones. These stones have been stolen for the palaces of modern Rome, and huge shapeless mountains of brick and mortar remain everywhere with high-sounding names, to give the lie to Piranesi's engravings, and to make the poets and historians of ancient Rome appear almost ridiculous. Yet, after all, there is still enough among all this wreck, when it is carefully considered, to prove what Rome once was, and how she surpassed all that now is in architectural magnificence. The Belvedere Apollo, Michael Angelo's Moses, Canova's studio, and the Dying Gladiator, have more than equalled my expectations. We are to leave

this in a day or two, for the seeing Naples is out of the question. I should not go there at present if here alone. For when the late disturbances took place at Palermo, all the English were informed that they were prisoners. None were molested, and all are now free, but God knows how soon a fracas at Naples might end, and it would be most tantalising to be shut up in a lodging, and not even allowed to witness the row. They are making very free with their favourite weapon the stiletto, and six or seven leading men are got rid of every night by those of the four different parties. General Church would be torn to pieces but for a guard of soldiers, and a threat of our ambassador's, that if a hair of his head is touched England will avenge it. The English have fled nearly to a man. Every peasant has become a soldier to support their *political opinions* in Parliament, which meets on October 1. Add to this 400,000 Austrians are expected there, whom they hate, and who surely can have nothing to do there, even if invited by one party. These Germans must in their way pass through the Pope's territories, where they are so much detested that they will not, I expect, add much to their tranquillity. All may blow over, but were we to wait till we saw the event, the Alps would become impassable first, and it is my father's intention to recross them before we shall have any chance of rivalling Hannibal. Mount Leonessa, the highest Apennine seen from here, was completely covered with snow on Saturday last, when we took a grand view of ancient and modern Rome from the tower of the Capitol. This snow has now melted, but it proves how early winter may come in the higher regions.

My love to all. Your affectionate brother,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.[1]

29 Norfolk Street, Strand: February 8, 1822.

My dear Sir,—Though I was detained late in the country, I found you had not yet arrived with your book, but I still thought I should see you at our Annual Geological dinner.

[1] Dr. Mantell, F.R.S., author of *Medals of Creation*, *Wonders of Geology*, &c.

I now begin to despair, or rather to hope that your professional practice has increased so much beyond your expectation, that you find it impossible to leave Lewes. Of the collection which came quite safe in ten days, I can only say that I trust among so many valuable and interesting specimens you have not robbed your own of any which it might have been more advantageous for science that you had retained. The Professors of Cambridge and Oxford were present at our dinner, and Buckland was called upon to explain the vast quantities of bones which he found in the summer, in a cave at Kirkdale in Yorkshire, of which he had a large bagful with him: innumerable jaws of hyænas, teeth of elephant, rhinoceros, &c., unmineralised like those in the limestone caves in Germany full of bears. He produced some light balls or pellets, which he said he brought to town at first doubting what they could be. Dr. Wollaston[2] (I think) first pronounced they were like some calculi sometimes found in some species of Canis. Upon being taken to Exeter Change by Dr. Fitton,[3] the man there recognised the production, and exclaimed, 'Ah, that is the dung of our hyæna!' On analysing it they find it composed of carbonate and phosphate of lime, the same as hyæna's dung, which being an animal, it seems, of an ossiphagous appetite, has always its dung proportionately more ossified than any other. Buckland, in his usual style, enlarged on the marvel with such a strange mixture of the humorous and the serious, that we could none of us discern how far he believed himself what he said.

The researches I made at Christmas were, I am afraid, sufficient to prove that I must give up my hopes of discovering the Isle of Wight fresh-water formations in our part of Hants, but the shells are not yet come to town which will enable Webster to decide.

Believe me most truly yours,

CHARLES LYELL.

[2] Dr. William Hyde Wollaston, natural philosopher, b. 1766, d. 1828.

[3] Dr. W. H. Fitton, b. 1780, d. 1861, an early member of the Geological Society, contributed many papers, and clearly defined the position and character of the Green-sands as separated by the Gault.

To GIDEON MANTELL, ESQ.

29 Norfolk Street: April 11, 1822.

I fear you may think I have but little motive for troubling you with a letter, since it is no other than to inform you that I am to-day setting out for Winchelsea, where I shall pass nearly a week with a friend, who will leave me ample time for geologising if I can find a field for such operations, and for myself I have little doubt of this, since the country is so entirely *terra-incognita* to me; but can you not also make me useful to you in ascertaining any fact or procuring any specimens? In several short expeditions which I have made into Surrey I have examined very carefully the junction of the chalk with the beds below, about Reigate, Dorking, and Guildford. I have brought specimens from what Webster would have us call the ferruginous sand, exactly like some brought from the green-sand of other parts, which certainly creates a great difficulty, but still there seem to me only partial beds in that which we should decidedly call iron sand in any other place, and I still think that if we were determined to name beds by analogy to those of which Webster first drew the line in the Isle of Wight, we should be obliged to pronounce that *the green-sand* is wholly wanting at Guildford, and Greenough seems clearly to entertain great doubts on this head himself, but when I have worked more eastwards in Kent I shall be better able to form an opinion.

Since you were here, there came up from Stonesfield to the Geological Society a most enormous bone of some great unknown animal, and Clift pronounced it new, but finds it belongs to the same animal as one which some time since was sent from the neighbourhood of *Cuckfield*! Would it not form a strange addition to the wonderful coincidence already discovered by you, between your beds and those of Stonesfield, if an immense new animal should at the same time be found in each? This animal, they say, must be as large as an elephant, but I cannot learn of what kind they conjecture.

Yours very truly,

CHARLES LYELL.

To His Father.

Winchelsea: April 16, 1822.

My dear Father,—I had always intended to appropriate the first rainy day to the transmitting to Bartley a narrative of my adventures in these distant parts, but the weather has proved so fortunate that this is the first opportunity which has occurred. My journey through Kent by Sevenoaks, Tunbridge, and Rye was so stormy that I saw little of the scenery, but I should think the view from Madam's Court Hill near Sevenoaks must surpass all the rest. This is a most picturesque and delightful spot, and the sea-beach and the marshes, the cliffs and fine old ruins, have entertained me so much, that I could stay a much longer time here alone, and not feel a moment's *ennui*. Among other things I have found the Hastings and Battle limestone rock, with its peculiar fossils in the cliff of that isolated hill on which this borough stands, which I believe is the most eastern-most point in which it has been seen, and I hope will settle Mantell's doubts about its position, as I have here found in the perpendicular cliff the bed of sandstone which is above and below it. The destructive incursions of the sea at different periods all along the coast afford very copious and curious matter of observation as well as of speculation. I took advantage yesterday of a light cart, the only conveyance about here, to go through a great part of that wonderful place Romney Marsh, now richly studded with ewes and lambs. It set me down within two and a half miles of Lydd, where I called on my fellow-collegian Denne. I did not find him at home, but on my way back I met him. He holds in his own hands 900 acres of the marsh! on which he observed I might easily conceive how much capital he might soon sink in these times, and much he has sunk. All the old families of Kent nearly have had or have some property here, but have cut the marsh as soon as their wealth would permit them. Denne is without society, but as they have elected him every year head magistrate of their jurisdiction, and as he is justice of the county, he says he has employment enough to render him independent of it. Perhaps you would think 900 acres might do so alone. Their house is

just in the town and is good enough for any gentleman, but the back-door opening into the farmyard betrays the predecessor to have been the farmer turned gentleman, not the gentleman turned farmer. How short and direct is the road through Eton and Oxford from the grazier on Romney Marsh to the fine gentleman? or, to speak plainly, to the real gentleman in ideas, manners, and information. His uncle, Mr. Cobb, has just let a good deal of the marsh, *a few months since*, at 3*l.*, 4*l.*, and not a little at 5*l.* 10*s.* per acre! but the latter in small lots, and near the town, and then thought extravagantly high.

The sudden suppression of all smuggling at Lydd, Rye, this town and numerous others, threw more than half the population on the poor rates, and has made bankrupts of the tenants on many a large estate, and quite ruined some of their ports. Either the having permitted such license for ages, or the sudden stopping of an ancient source of gain, is unpardonable; for there is all the misery felt here which can possibly follow the total failure of a great manufactory. The harbour at Rye is filling fast, and will be soon added in spite of their exertions to the marsh, by the same causes which formed the latter; and though these are so evident, the people here, and old histories, and even my friend Denne, believe the idle story of its total formation during one storm. Had the sea retired suddenly it would have left nothing but shingle as at Winchelsea, and had our ancestors been as greedy in walling out the sea as this generation before it has half coated the shingle, there would be no acre worth 1*l.* per annum in all. I like the lodging here, and the old woman, who has only 3*s.* 6*d.* *a week* of her own, and 6*d.* *wages* to support *herself and a daughter* of near seventeen, which, though lodging, coal, and a small garden are found her, is a bare existence, and does not keep off the ague which is brought by the sea-breeze from Romney Marsh, and though it does not injure Lydd or Romney, does great havoc here and at Rye. This old woman, and she tells me others here, cannot afford to drink a drop of beer, while those who are not too proud to go to the poor rates live in comparative luxury.

Ever yours,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

29 Norfolk Street: April 19, 1822.

My dear Sir,—Although I did not leave Winchelsea until the 16th yet your letter did not reach me there but has followed me to town. Had I received it in time I might better have deserved the crown which you held up to my ambition, for I had no sooner begun my examination of the cliff there than I found myself in the midst of the limestone beds, with every character of strict identity with those of Battle and Hastings, particularly that gloss of rather the felspar appearance which you know marks it, and in which Webster was one day pointing out to me it closely resembles the crystallised part of the Fontainebleau rock—and no doubt it is owing to incipient crystallisation. The present town of Winchelsea is situated on a rock which projects like an island from the alluvial marsh-land which surrounds it, and which was once at no ancient date flooded by the sea; it presents a cliff more or less high towards every point of the compass. Close to the roadside, near the ancient gate which leads to Rye, is a quarry which affords a most satisfactory section of part of the rock. At the top is sand and sandstone, not much indurated nor highly ferruginous; then comes immediately under, and distinct from it, with not the least passage from the one to the other, a bed of the limestone, very hard and silicious, 5 *foot thick*; beneath this comes the sand again, of what thickness I could not ascertain. So much for the quarry which ends at the level of the road; but lower down the cliff appears another bed of the limestone, which must be far below the former, and proves therefore the alternation. The flat slabs of the limestone when weather-worn afford generally casts of innumerable small bivalves, of  this size (perhaps cardiums), and so does the sandstone exactly the same. In a walk of four or five miles along the high cliffs between Winchelsea and Fairlight cliff, I could see none of the limestone in the ferruginous sand, but I would have made more particular search had I known you had not been there.

What little I could see of the Weald clay makes me

think it quite subordinate to the ferruginous sand, and to doubt more than ever its answering in position to the Petworth clay of Buckland's syllabus.

Buckland has received from the Yorkshire Cave the bones of the weazel, the rabbit, the pigeon, and I believe one other bird in a beautiful state of preservation, and which are being drawn for the R.S.

Do not fear any poachers on your Sussex preserve. I wish I could see so much activity as to give cause of fear. At our meeting this evening I will not fail to introduce your prospectus, and nothing will give me greater pleasure than to take the first opportunity of paying you a visit. Yours truly,

CHARLES LYELL.

[In 1823 Mr. Lyell was elected Secretary of the Geological Society, and made excursions to Sussex and to the Isle of Wight, the results of which were not published till Dr. Mantell, in his 'Geology of the Isle of Wight,' 1847, gave extracts from Mr. Lyell's letters, dated June 1823, which showed that he had cleared up some of the obscurity in which the relations of the Lower Green-sand and Wealden strata were then involved. His first geological paper on the geology of some rivers near his native place in Forfarshire was read this year to the Society. About this time he made more than one visit to Paris, and became acquainted with Cuvier, Alexander Brongniart, Alexander Humboldt, Constant Prévost, &c.]

To GIDEON MANTELL, ESQ.

29 Norfolk Street: June 11, 1823.

My expedition to the Isle of Wight has very much confirmed the views which I before entertained of the geology of Sussex. Professor Buckland, who was of the party, though he did not altogether give in to a theory which he admitted was new to him, was still clearly surprised, when I pointed out to him the fact that there was everywhere in the Isle of Wight beds of sand below Webster's blue marl greener than those above. You are aware that Webster never found in his blue marl any fossils except two Ammonites. At Compton Chine, however, I found several small

Inocerami (*I. sulcatus*, I believe), and, although I was only there five minutes, I saw so many fragments of shells in this same blue marl that I am inclined to believe the identity of this bed with the blue marl of Folkestone and the Gault might be made out by a further search for the organic remains which it contains.

The section from Compton Chine to Brook is superb, and we see there at one view the whole geology of your part of the world, from the chalk with flints down to the Battle beds, all within an hour's walk, and yet neither are any of the beds absent, nor do I believe they are of less thickness than with you. This is so beautiful a key, that I should have been at a loss to conceive how so much blundering could have arisen if I had not witnessed the hurried manner in which Buckland galloped over the ground. He would have entirely overlooked the Weald clay if I had not taken him back to see it.

This clay, however, is only partly exposed, the softness of it having caused a ruin of the cliff, just at the point where the Petworth marble ought to be looked for. Soon after this sandstone containing layers of limestone with bivalves appears, then some mottled beds purple and white, then Pyritous coal like that at Bex Hill I suppose. The white sands of Winchelsea and Fairlight are magnificently exposed, &c. &c. I staid a day longer than the rest of the party, for the purpose of searching in the Weald clay of the Culver cliffs section for Petworth marble, but the cliff is there also in ruin; I found, however, a rounded block of it two feet or more in diameter on the sea-shore, nearly opposite the Weald clay, specimens from which I have brought to town, some of which are at your service, with many specimens from the Fresh-water formations which I collected for you, and will send you when I have more leisure to pack them up. Almost the whole of the back of the Isle of Wight is in such a dreadful state of ruin, that I believe it has been the cause of much of that confusion which has found its way into the heads of some of our geologists with regard to your Sussex beds, and some of those very same geologists whom I have heard ridicule De Luc for supposing he had there discovered chalk beneath the green-sand.

You will be very glad to hear that Mr. Warburton,[4] on whose accuracy above all men we may rely, says that above the Gault in Cambridgeshire green-sand occurs, as well as below it; this upper green-sand, as well as the firestone of Reigate, he chooses to consider as part of the lower chalk. Yet both he and Dr. Fitton choose to call the beds at Beechy Head green-sand, supposing it to belong to that which is below the Gault. In this they are completely mistaken. I am going to Paris towards the end of this month; if you wish to send any presents of books or anything to anyone I shall be very happy to be the bearer of them; indeed it will be of advantage to me, as affording me some introduction to the donees, and, as this visit of mine is principally to perfect myself in the language, I court everything which brings me in contact with Frenchmen. I like De Beaumont much. Yours very truly,

CHARLES LYELL.

To HIS FATHER.

London: June 21, 1823.

My dear Father,—I am fortified with most excellent letters of introduction from Buckland, Greenough, Grey Bennett, Professor Brochart, Dr. Fitton, Webbe and Lambert, &c.—to Humboldt,[5] Cuvier,[6] Brongniart, Cordier, Duvau, Prévost, Lefroy, Royer, &c. Buckland has also made me the bearer of presents of his new work to many of the above, and I have sets of specimens of my Scotch and Isle of Wight rocks to give away.

We had a very full meeting of the Geological last night; many foreigners at our club dinner, who were very entertaining. Professor Oersted, of Copenhagen, pronounced the following eulogium of our scientific dinners of which, as it was spoken in English, you may imagine the ludicrous effect. 'Your public dinners, gentlemen, I do love, they are a sort of

[4] Henry Warburton, one of the founders of the Geological Society of London in 1807.

[5] Alexander von Humboldt, eminent naturalist and philosopher, b. 1769, d. 1859.

[6] George Cuvier, comparative anatomist, b. 1769, d. 1832.

sacrament, in which you do beautifully blend the spiritual and the corporeal!!'

A Mr. Underwood dined with us, who was so long a *détenu* in France that he now resides there, preferring it to England. He said, 'The Bourbons are becoming much more arbitrary than before the Revolution; the prisons are full of political offenders. A looker-on sometimes sees more than those who are actually engaged, and my opinion of the French people is, that they are much too *corrupt* for a free Government, and much too enlightened for a despotic one.'

I send you a specimen of Petworth or Sussex marble, better polished than that which you have. With my love to all, believe me, your affectionate Son,

CHARLES LYELL.

To HIS FATHER.

Hôtel Meurice, Paris: June 28, 1823.

My dear Father,—I left London Sunday, June 22, at nine o'clock, in the 'Earl of Liverpool' steam-packet; crossed to Calais *in* 11 *hours*! 120 miles! engines 80-horse power, for 240 tons. Lord Lonsdale on board. As I was not sick at all, he conversed with me much.

Sir Ralph Anstruther, a great friend of Sir J. Ramsay's, was also a passenger, a young Scotch laird, has property in Fifeshire and Caithness. I introduced myself as a friend of Sir J., and he asked me to go with him to Abbeville in the cabriolet of the diligence. The next day he took me in a carriage which he hired to take him to Lisieux, near Caen, some miles on the Neuchatel road. I then returned geologising to Abbeville, and spent the day in seeing the manufactures of cloth, carpets, glass, &c. At the former they have erected lately an *English* steam-engine of 18-horse power, which enables them to dispense with 1,000 workmen. The heads of these factories are very rich, and all *liberals*. They seemed quite delighted to find an Englishman to whom they might pour forth their abuse both of *their own* and *our* ministers, which they did without sounding me as to my politics. To the intrigues of our Cabinet they impute the

counter-revolution in Portugal. Since the peace they have established two monasteries for friars, and two for nuns at Abbeville, and they are now building another nunnery. The next day I went on per diligence to Paris.

Ramsay was gone to Baden when I arrived, and I shall certainly not go yet to the Esmenards, as there are two Englishmen there who talk nothing but English. Judge Richardson introduced me in town to his *marshal*, Bosanquet, a barrister of Lincoln's Inn, who gave me a letter to Hunter, a gentlemanlike young Englishman who has a place in our foreign office here. He takes me to-day to a French family, where I shall hear their language alone spoken, and where, if I fancy it, I may *place* myself; if *not*, dine there for 3 francs when I like. Grey Bennett's friend, Duvan, called this morning; he is a very pleasant man, has been in office, now lives on his own fortune; his hobby is botany. He takes me to Cuvier's *soirée* to-night, when I shall deliver my letters, &c.

To-morrow morning I am to attend Brongniart's[7] *levée*, to whom I have four letters, and who among the English *geologists* has the highest reputation both for knowledge and agreeable manners of all the French *savans*. I have left my letters and Buckland's book at Humboldt's (or, as his porter calls him, Hoombowl), but did not see him. I called on the Airlies yesterday, saw Lady A. and Mrs. Drummond; the former looking very well, and in high spirits. She says there are not so many English here as there were, and the price of lodgings and houses sensibly diminished.

All the French gentry attached to the Court whom they see accuse all the English, both Whig and Tories, of being Radicals and Revolutionists, and they are much piqued that the Duc d'Orleans' *levées* are so much more splendidly attended by English *noblesse* and gentry than the Court.

Your affectionate Son,

CHARLES LYELL.

[7] Alexander Brongniart, a distinguished chemist and mineralogist, b. 1770, d. 1847.

To His Father.

Hôtel Meurice, Paris : Friday, July 3, 1823.

My dear Father,—I have passed my time here as yet very much to my satisfaction, but I fancy I have not been advancing so much in my acquaintance with the language as with the *savans*, to whom my numerous letters gave me a most favourable introduction. My reception at Cuvier's last Saturday will make me feel myself at liberty to attend his *soirées* every week, and they are a great treat. He was very polite, and invited me to attend the Institute on Monday. There he introduced me to several geologists, and put me in an excellent place for hearing.

Miss Duvansel, daughter of Cuvier's present wife by a former marriage, is a young woman of most engaging manners, and very clever, talks English (as does Miss Cuvier) excellently ; she is pretty, and very lively. She is not a slight acquisition to the attraction of Cuvier's *levées*, and the more so as *he* is *by nature* reserved and uncommunicative in his conversation. We had a collation of fruit, &c.; the chief discussion was on Sir Walter Scott's last novel,[8] the scene of which is in France it seems. Cuvier is delighted with it, as were the ladies.

Humboldt addressed me, as Duvan had done, with, 'I have the honour of being familiar with your name, as your father has laboured with no small success in botany, particularly the Cryptogamæ. I suppose when he was in Paris I was absent, or of course I should have met him somewhere. But I hope if he comes again to be more fortunate.'

He was not a little interested in hearing me detail the critiques which our geologists have made on his last geological work, a work which would give him a rank in science if he had never published aught besides. He made me a present of his work, and I was surprised to find how much he has investigated the details of our English strata. I am going to him this morning with some specimens, to make him master of the last point which was cleared up in my Isle of Wight tour with Buckland, and afterwards he takes me and Sir J. Croft to the Observatory to show it to us. He appears to work hard at astronomy, and lives in a garret for the

[8] *Quentin Durward.*

sake of that study. The King of Prussia invited him to adorn his Court at the last Congress; thence he went to Vesuvius just after the grand eruption, and brought away much geological information on that head, which he was good enough to communicate to me. He speaks English well. I attend lectures at the Jardin du Roi, on mining, geology, chemistry, and zoology, all gratis! by the first men. The lectures both summer and winter are very numerous. I am sorry I am obliged to conclude, as I have much more to say. I dine every day at Madame Guien's, where we talk mostly French. They are friends of Hunter's.

My love to all, and believe me, your affectionate Son,

CHARLES LYELL.

To HIS FATHER.

Hôtel Meurice, Paris: July 8, 1823.

My dear Father,—Although I do not believe I have anything to say which would much endanger my being treated like Bowring with the Bastille, yet I write with more pleasure, as I know my letter will not be opened by the channel through which I send it.

The seals of many letters going to England, and still more of those into the interior of France, are broken, which Royer tells me 'is very *proper*, for it has been the means of detecting many enemies!'

Humboldt took me on Saturday, as he had promised, to the Observatory with Sir John Croft, who has a property in Yorkshire, was once in a diplomatic situation with Canning at Lisbon, from whom he brought letters to Humboldt. On our way Humboldt talked with great vivacity and force, of which I may perhaps give you some idea. 'No, Cuvier gives no lectures, and the reason I regret to say is, that he is still a Politician—no, you were mistaken, if you imagined that the ministry have reached a pitch of ultraism beyond him, I sent him back to his books. That time is yet to come. You observe that his *soirées* are mostly attended by English; the truth is, the French *savans* have in general cut him; his continual changing over to each new party that came into power at length disgusted almost all, and you know that it has

been long a charge against men of science, that they were pliant tools in the hands of princes and ministers, and might be turned which way they pleased. That such a man as Cuvier should have given a sanction to such an accusation was felt by all as a deep wound to the whole body. And what on earth was Cuvier to gain by intermeddling with politics? If his ambition could have reasonably flattered itself with the hope that his talents might one day open to him the heights of power, the attainment of *such an object* would have been an excuse for his having *the weakness to desire it.* But this he full well knew was impossible in France. First, because he was a *Protestant*, and, secondly, because he was a man of *low family*. You well know with what contempt the old aristocracy of all countries are apt to regard all new men of whatever abilities. *We* feel that but too much in Germany, but *here* it is a principle of party now to carry such prejudices to the utmost length. Cuvier's situation was a proud one while he stood in the very foremost rank of men of science in France, but when he betrayed the weakness of coveting ribbons, crosses, titles, and Court favour, he fell down to the lowest among his new competitors.' 'The Duke d'Orleans has 320,000*l.* sterling per annum. He is liberal, though he does not spend his income, for he puts by for his numerous family. He is domestic, though he lives in princely style. He likes the English, and deserves to be the favourite, which he is, with them.' 'You cannot conceive, gentlemen, how striking and ludicrous a feature it is in Parisian society at present, that every other man one meets is either minister or ex-minister. So frequent have been the changes. They are scattered as thick as the leaves in autumn, stratum above stratum, and before one set have time to rot away, they are covered by another and another, and on the last are sure soon to fall those which are now blooming in full verdure above them. The instant a new ministry is formed a body of sappers and miners is organised. They work industriously night and day. They are more religious, more constant at mass, more loyal, and, above all, they know better how to ape exactly not only the ideas and manners, but the very air and the expression, of their ancestors of some centuries back. At last the minister, as Chateau-

briand and Vilelle for instance at this moment, find they are become heretics, Jacobins, infidels, revolutionists—in a word that they are supplanted by the very arts by which a few months ago they raised themselves to power.'

At the entrance of the Observatory we met Le Marquis de La Place,[9] a very fine-looking old gentleman. The famous mathematician Arago [1] did the honours of the Observatory, where we staid some hours. On Arago's pointing out from the top some newly-built monasteries, Humboldt observed, 'We have made a calculation, and find that there exist already more religious houses in Paris than before the Revolution.' This extraordinary statement did not seem to startle Arago, but Duvan, who, though a placeman, is far from violent in politics, assures me it cannot be true; he said, however, 'The assertion is so curious that I will inquire.' Humboldt said, 'These houses do not *yet* contain so many *inmates*.' After what I have given you concerning Cuvier, I ought in justice to add my own opinion, which is that he is more liberal and independent than I believe most Frenchmen are. He dares to speak and often with praise of Napoleon, and before Frenchmen, who might, and no doubt do, turn it against him. We must not forget that Baron Humboldt and he are the two great rivals in science, for La Place and the mathematicians do not come in contact with them. Humboldt's birth places him on the vantage ground, and Cuvier perhaps tries to compensate this by a little political power. As for his *ratting* so often, *defendit numerus*. What French politician could throw the first stone at him? Humboldt's family is noble and ancient in Germany. His elder brother a man now in great power there. His talents entitle him to regard with the contempt which he expresses, and I have no doubts feels, for *mere rank*, but we may say of him as Chateaubriand said of our English Peers, that he is well aware that while he gets too liberal, he is in no danger of losing the station and the advantages which his birth ensures for him. I dined with the Airlies to-day.

I hope I shall soon hear from Bartley.

My love to all, and believe me your affectionate Son,

CHARLES LYELL.

[9] The author of *Méchanique Celeste*, b. 1749, d. 1827.

[1] Francis Arago, astronomer, b. 1786, d. 1853.

To His Father.

Hôtel Meurice, Paris : July 13, 1823.

My dear Father,—Your letter of the 4th arrived on Friday. The rain, which has injured your hay, has fallen almost every day since my arrival here, and the Parisians talk of the weather as if it was the most serious misfortune. It has a great effect on their spirits, and no wonder Montesquieu, as a Frenchman, dwells so much on climate as the cause of national character. A lady said to me at dinner the other day, 'There is a revolution in the heavens, and the Duc d'Angoulême should be sent to quell it, for in truth he is too good for us here.'

I have learnt, however, from a quarter that leaves me in no doubt, that the Duke and all the Royal Family, except the Duchesse de Berri, were against the war, as well as the ministers. The Duke is decidedly hostile to that 'extreme right' whose fanaticism carried everything before it. Almost all the less violent royalists are still in doubt whether it would not have been better to let alone the campaign, but as that is now impossible, they reason thus : 'We shall derive from the war in Spain two great advantages ; first, the cannon has been fired under the white flag, the army is now decidedly with us : this gives a consistency and weight to the Bourbons which they before wanted. Secondly, the Duc d'Angoulême, who is a man of more *vous* than the English give him credit for, has acquitted himself with honour. He entered upon a dangerous expedition, and in which *he* least of all expected there would prove no severe fighting. The consideration and weight which he has acquired with all will be employed at home against that growing evil, the extreme right, which, if unchecked, must ere long occasion serious mischief in France.' My fear is that when eighty-five new deputies are added next year, the *ne plus ultra* Ultras will acquire as much additional force as they did this year. I am told the new French loan of Thursday last was equal to the greatest sum ever raised in England in one day during the last war. It has added to their debt 18,000,000*l.* sterling, and something more, which, with the 5,000,000*l.* with which they started, is no

small expense even were the business over. In spite of the revolutionary sponge, their debt will shortly be no trifle. Next year the interest will be well on to 13,000,000*l.* sterling I suspect; and if ours was reduced to three per cent. (and I hear Robinson will make a great step towards this next year), ours would only be 26,000,000*l.*, or double the interest of the French. Mons. Corriglione, brother-in-law of the famous Carnot,[2] dined with us the other day. He has some landed property near Paris. He says the stagnation of commerce has depressed agriculture here in an unprecedented manner. Wool, which was at fifty sous when the army entered Spain, has fallen to twelve sous.

My fellow-collegian Rickards arrived in Paris yesterday, and persuaded me to give two guineas to the Greeks, which I do with great pleasure, and not the less so, though Dalby stands up for the Turks. He was a staunch Liberal when starting for the bar. Since he has decided on the Church, Rickards says he has grown too hot, even for Oxford, in Toryism. He abuses Canning and Co. for opposing the most sacred of wars against Spain, &c. &c. Tyndall, one of the young Englishmen in the house where I dine, has just received from the Greek Committee the appointment of surgeon, and a letter to Lord Byron, whom he sets out to join to-morrow. I was glad to hear the Cantabs have had a subscription for the Greeks. The Airlies I am sure will feel it no effort to settle in Angus, for they seem to talk and think of nothing else: they had intended to go to Switzerland and Italy, but all is given up. Maule's son,[3] it seems, has gained his action. Lord Airlie remarked, 'I am sorry for it *as a general rule*, for in entailed estates sons were but too independent of parents before.' I quite agree with him, and as no doubt Maule will appeal, I shall be glad to see the judgment reversed in the House of Lords. A Mr. Buchanan,

[2] Minister of War under the consulate of Napoleon, b. 1753, d. 1823, author of mathematical works.

[3] The Hon. Fox Maule (heir apparent to the Hon. William Maule of Panmure, who was in possession of an estate of 10,000*l.* a year), having 90*l.* of pay as an ensign in the army, and 100*l.* a year from his father, was found entitled by the Court of Sessions, to whom he applied, to an aliment of 800*l.* per annum. This decision was afterwards reversed by appeal before the House of Lords.

nephew of Mr. Ogilvy of Tannadice, who has met you, dined there, and said Gray of Carse is in ecstasies. He says, 'Aliments for ever! I shall get my son to sue me, and we shall extract something from the creditors.' I remove to-morrow to 9 Rue Montabor.

Your affectionate son,

CHARLES LYELL.

CHAPTER VI.

JULY 1823—OCTOBER 1824.

ALEXANDER BRONGNIART — MANUFACTORY OF SÈVRES — M. PICHON — TERTIARY FORMATIONS AT MEUDON—M. CONSTANT PRÉVOST—MARSHAL SOULT'S GALLERY—POLITICAL DISCUSSION AT CUVIER'S—EXCURSION TO FONTAINEBLEAU WITH M. CONSTANT PRÉVOST—DIVISION OF PROPERTY—BARON DE FERUSSAC—HIS COSMOGONY—POLITICAL CHANGES IN FRANCE —VERSAILLES—GEOLOGICAL EXCURSION TO THE MARNE—CENTRALISATION OF PARIS—RETURN TO ENGLAND—REV. W. D. CONYBEARE — PLESIOSAURUS FROM LYME REGIS—CONSTANT PRÉVOST'S VISIT TO ENGLAND—KINNORDY—ACCOMPANIES DR. BUCKLAND TO ROSS-SHIRE.

CORRESPONDENCE.

To His Father.

9 Rue Montabor, Paris: July 20, 1823.

My dear Father,—Friday morning I entered, by a ticket from Duvan, the Garde Meuble. The new crown, which is made entirely of diamonds and amethysts, is the most elegant and tasteful, as well as costly piece of jewellery I have ever seen. Afterwards I went by invitation to Sèvres, where Brongniart showed me the whole process of the manufacture, and explained it mineralogically. I then dined with his family, and a delightful party. His sister, Madame Pichon, has been a celebrated beauty, and sat for Gerard's Psyche. Her husband was *Chargé d'Affaires* of France in the United States for five years. She speaks English, and adores America to a degree that surprises me. Her husband wrote a work on politics, the object of which was to prove the possibility of introducing the English Constitution into France, and from his attacks upon Napoleon's tyranny was obliged to fly to England during the Hundred Days. Nevertheless, he was cast out lately from the Council of State, for

giving it as his opinion that the King could not authorise the taking the veil in convents, without the Chamber repealing the existing laws against it. Cuvier, a Protestant, was President of the Council, and gave his vote the other way. Since this time the Protestants of Paris, who before looked up to him as a leader, have held him in abomination. He also sanctioned the Missionaries. Le Baron Coquebert de Montret, Brongniart's father-in-law, was also there. I had read an essay which he wrote lately, to accompany a geological map of d'Alloi's, showing the connection between the geology and statistics of France. He was for many years from 1806 Consul-General of France at London—thoroughly acquainted with England and many of our leading men, and has spent much time in Ireland, the whole of which except three counties he has been over. His country seat is near Sèvres on the banks of the Seine, at Bas Meudon, and as there is exposed there a fine section of all the Tertiary formations of the Paris basin, from the chalk upwards, he very politely asked me to come and breakfast with him yesterday, which I gladly consented to. He took me over the whole ground himself, and gave me a delightful statistico-geological lecture on the formations. I was much gratified at the analogy between this section and the same beds in the Isle of Wight. I made a collection of specimens, and after declining an invitation to dinner returned to Paris. I found him occupied in making tables of the comparative population, increase of finances, &c., of Great Britain and France; and he was not aware, though he reads English works so much, that Lowe had anticipated him. I begged for Lowe a copy of a memoir which he has just written for the Geographical Society here, on the comparative population of Les Iles Britanniques and France, the object of which is to check the fears of many Frenchmen, who oppose themselves to every improvement here, on the ground of its occasioning an increase of population, which idea they have chiefly derived from mistaking Malthus.

With my love to all, believe me your affectionate son,

CHARLES LYELL.

To His Father.

51 Rue Richelieu, Paris : July 28, 1823.

My dear Father,—I have now finally settled in Rue Richelieu, No. 51—two very nice rooms for fifty francs a month ! ! I went over to breakfast and dine last Wednesday with Mons. Prévost,[1] a friend of Dr. Fitton's, at his country seat at Montmorency, about a league the other side of St. Denis, and met another young French geologist there. A long walk which we took gave me a great knowledge of the geology of the environs, which is very interesting. Prévost has travelled much in Europe, is a man of good fortune, and an excellent *Géologue*. He has come to Paris since, and I dined with him yesterday at his house here, a pleasant party, consisting chiefly of his wife's relations, who have a good deal of land in the neighbourhood of Paris. I have promised to spend the whole of next week in different geological excursions with him, chiefly in the neighbourhood of Fontainebleau, at his own mother's. We are to visit the millstone quarries which supply nearly all Europe and North America.

At Cuvier's, on Saturday, the conversation was more than usually interesting, chiefly on Napoleon. Cuvier vouches for the truth of a great part of Las Casas' narrative of events, &c., at many of which he was present here. He has been all along very obliging to me, and the other day he asked me to dine with him next Saturday, and said, 'I shall assemble some of our geologists to meet you.' Sir J. Croft and I meet often, and are very good friends. He says the labour of those attached to embassies is often prodigious, eighteen hours a day, and he has known many knocked up, and himself nearly. It is pure drudgery, as, for instance, adding up and copying the Ambassador's washerwoman's bill ! If my eyes were equal to half this, I would take to the law in earnest, which would introduce me to society of which I have an infinitely higher opinion, and to a description of labour which is even, when most dry, an exercise of the reasoning powers. Sir John is a well-informed gentlemanlike man.

[1] M. Constant Prévost, an eminent French geologist.

I believe I am improving in the language, as much as can be expected from one who is obliged to abstain from writing exercises, and almost entirely from the theatres and reading French works.

My love to all, and believe me your affectionate son,

CHARLES LYELL.

To HIS FATHER.

Paris: August 3, 1823.

My dear Father,—I had intended to have written yesterday, when I had time for a long letter, but my eyes were so fatigued I was obliged to lay down my pen. By way of resting them, I escorted Lady Airlie to Marshal Soult's magnificent gallery of Murillos, of which master he has a collection of immense value and beauty. Afterwards we went to the Duc d'Orleans', where there are many by modern French artists, which are said to have merit, but for which we were perfectly spoilt by having feasted on the splendour of the Bolognese school. Madame Pichon invited me to a soirée on Friday, and introduced me to her husband. I believe I gave you a part of their history. When *Chargé d'Affaires* in America he opposed Jerome Buonaparte's marriage with Miss Patteson, for which Jerome got the Emperor to *disgrace* him. Two years afterwards Jerome was made King of Westphalia. He then wrote to Pichon that he had used him unjustly, and as compensation had appointed him Minister of his Treasury. The Pichons accordingly went to his court, and lived there in great style. He held lately some high place in the administration relating to Law Appointments, which he lost by opposing the Missionaries, a system which Madame says is driving as fast as possible all the French into two sects, *Bigots* and *Deists*, for they are making their religion too superstitious and absurd for persons of *education* in the nineteenth century.

Mons. P. seems clever, is very well informed, and communicative, and the house will be a great resource for me, as I have a general invitation, which I have no scruple in availing myself of in Paris, as they do not ever give tea at their evening conversations. He mentioned that the

Government have the nomination, on the average, of 1,200 law places of considerable emolument *annually!* The number of Judges (not counting Justices of Peace, who are also paid) is 2,500. These are for life, but there is a regular chain of promotion, for which they are all panting, which makes the whole machine a most formidable political weapon. The number of decorations of ex-ministers in the party reminded me of Humboldt's remarks. When I gave Madame Guien (the Protestant lady with whom I have been dining *en pension*) an account of this, she said, 'Faith, what between things spiritual and temporal, "c'est le règne des croix."'

At Cuvier's dinner-party yesterday there was a discussion as to what were the motives which induced Lord Castlereagh to kill himself, in which all the French assumed that it was a deliberate act. Upon some one observing that Lord C. had a surprising power, when he liked, of talking for hours without imparting information on subjects on which he did not choose to be clear, Cuvier said, 'I suppose then he was of Talleyrand's opinion, who declares "that speech was given to man, the better to enable him to conceal his thoughts."' The Abbé Florini, an emigrant, who has been thirty years in England, and now here only on a visit, was amusingly violent, said our Press was an insupportable nuisance to ourselves, and to France, &c. After dinner he was arguing with me on the Spanish War, when Cuvier came up and said, 'Mr. Lyell, you must come with me into my study, for I want to show you a collection of English law books, which, as an English barrister, you will be amused at finding in my library. I interrupt your argument without ceremony, because I know better than you do the serious scrape from which I extricate you. Let me tell you, sir, that my good friend the Abbé (tapping the Abbé on the shoulder) is a man of old and noble family in France, besides this he is an Abbé, and moreover an *émigré*, and all these grafted on an English Tory. Is not this enough to form a compound which may support even all that we can here produce of Ultraism?' At this he laughed freely, and the Abbé joined with a good grace. What made the scene more amusing and extraordinary to me, and what I believe enabled the Abbé to bear with the joke, was that Cuvier is

himself notoriously considered an Ultra, and I fear with too much reason, one of the most mischievous Ultras in the present *Conseil d'État*. There was a full *levée* in the evening, and he held forth on his new work which is just coming out, on Fossils of Cetacea. His reflections on the former state of this planet and the creation were so grand, and delivered so elegantly and so unaffectedly, that when he finished I could not help regretting that he had dabbled so much with what Sir J. Croft styles 'the dirty pool of politics.'—Your affectionate son,

CHARLES LYELL.

To HIS FATHER.

51 Rue Richelieu, Paris: August 10, 1823.

My dear Father,—My excursion into the country last week with Mons. Prévost proved a very pleasant and instructive one. Our route was by Mélun, Fontainebleau, Moret, Montereau. We had the satisfaction of discovering some new geological facts, and I gained a pretty correct knowledge of most of the formations of the environs and of the position of the *grès*, or sandstone of Fontainebleau. The forest is very varied, contains some fine timber, and a few views which are singularly wild and picturesque. We start next week on a second campaign. I slept two nights at Mons. Bevière's, near Mélun. Prévost's father-in-law is a very gentlemanlike old man. His father was rich, and Napoleon made him a Senator, which added 35,000 francs per annum to his fortune of 40,000 a year. Prévost has married a daughter of Turgot, the famous French advocate, who regained before his death part of the land which he lost at the Revolution, and left 900 acres, very rich, in the neighbourhood of Paris. His widow enjoys half for her life, which will be at her death equally shared by the son and three daughters, who possess already equal parts of the other moiety. Young Turgot, whom I have met at dinner, has married a young lady of Normandy, who will inherit a great fortune, and he hopes to become deputy of that province. He is an advocate, but does not practise except when he volunteers a defence in

some political case, which he has done several times. He seems a clever but rather violent Liberal. *La loi commune* is, I should say, a favourite with the best informed and most candid men whom I have yet met with here. Even Baron Montret, who is fully aware of all that can be objected against it, confesses that he should hesitate much before he could give his vote against it. Prévost says the immense size of properties before the Revolution was a great evil, and that the division has increased the wealth and population of the nation, and the general ease and happiness. Mons. Pichon says that there are 12,000,000 *propriétaires* in France out of 30,000,000! This law was the subject of an animated discussion between several Frenchmen at Cuvier's last night. They mentioned, as a favourable result of it, the facility with which young ladies married, and alluded to the difficulty which those of a certain rank in England found in settling, and the numbers that never did, as no small evil. But without reference to the merits or demerits of the system, there is no institution of which the effects are more remarkable, or better worth studying in France at present; and if it lasts fifty years more, the contrast between England and France will be most curious, whichever nation it may be in favour of. Prévost has travelled much over France, and he says he has never known a single château of a certain size (about the size of Bartley) erected in modern times. In the provinces the demolition of the old ones is most rapid. Even near Paris he cited seven great châteaux which have been sold and pulled down *since the return of the King*. Perhaps the most remarkable of these (of all which I have made a list) is Montmorency. General Arrighi laid out 50,000*l.* sterling just before his death in having the walls and ceilings preserved. It was sold, and the stones of the house and the park walls burned into lime. The same law which brings large estates into the market makes it impossible to find a purchaser for them. Large companies of speculators are organised, who buy up these mansions for the materials, and the French are uncharitable enough to call them *les bandes noires*, from the analogy of their occupation to those adventurers of that name who bought up the churches and châteaux at the Revolution, and generally paid

the purchase money by the lead alone with which they were covered. If a merchant gives a dowry to his daughter at her marriage, and dies bankrupt, or, as constantly happens, with his affairs in a less flourishing state than at the time of the wedding, she must bring her fortune back to be divided among the brothers and sisters. If *she* is dead, still her children must *refund*, and this is the cause of no little confusion and insecurity, and is no bad harvest for the lawyers. By the way, Cuvier mentioned last night that the number of *Étudiants en droit* at the college has exactly doubled since the peace. He also said, with regret, that the study of mathematics was going fast to decay, and explained why the smaller scale of their war department necessarily occasioned this. I have made acquaintance with Le Baron de Ferussac, a colonel on the staff of the French army, who went through Napoleon's Spanish campaigns. He is a lively young man of very pleasant manners, of an old family, and in the first society. He is engaged in publishing a work on the Molluscæ, and has studied much those branches which relate to Geology. He has the finest collection by far of land and freshwater shells in the world. I spent two mornings with him, and he is certainly the most brilliant builder of theories I have ever met with. I fought hard with him for Buckland's notions of the Diluvian formation, in which Ferussac is not orthodox. A cabinet geologist can account for everything much more easily than one who takes the field, and looks all the difficulties in the face; but he is very ingenious, and his knowledge of shells gives him a powerful clue. As you have almost said enough to provoke a geological letter from me, I will endeavour to state in a few words an outline of Ferussac's cosmogony. He says geology yields ample proofs, both that the ocean was at a much higher level than at present, and that the general temperature of the earth has decreased. That from chemical reasons the diminution of heat would naturally be attended by a subsidence of the waters. That from the organisation of the molluscæ, some can only live at great, others at slight depths. On the shores and shallows of the Mediterranean different species now exist from those in the deep parts, and that we may conclude totally different ones again dwell in the fathomless

sea. In this manner he accounts for the oldest and lowest beds presenting us such totally different fossils from the superior ones, and the reason that as we ascend in the series the productions resemble more and more those which now live, is merely because the ocean, as it became shallower, contained animals more and more analogous to those which alone we have now access to. At length the chalk was deposited, and covered with its analogous formations almost all the continents we know anything about. Much land was then left bare, and freshwater formations began. The present system of valleys did not then exist, of which there is proof, and instead of the waters being carried off, as they are so beautifully at present, the whole was nearly covered with great lakes, of which we know thirteen, those of the London and Hants and Paris basins being three. All these thirteen present similar phenomena of alternating fresh and salt water formations, and mixtures of both. As the ocean was then still nearly on a level with the chalk, it often broke down a dyke, as in Holland, and deposited oysters, &c., once more. Analogous phenomena may now be seen in progress in the Caspian and other inland lakes, &c. I wish I had room to go on, but I find I shall be unable to tell you my plans. I am going with Prévost this week to see those parts of the Paris basin which I have not yet seen. In a month I think of leaving this. I went to a delightful soirée at Madame Pichon's on Friday. Humboldt was there. He told me that as soon as I have finished my tour with Prévost he shall get me to give him two mornings, and shall read over to me all he has written on the tertiary formations for his second edition, as I have now compared the Isle of Wight with Paris. Besides obliging him, I shall get a good *cram* by this.—Your affectionate son,

CHARLES LYELL.

To HIS FATHER.

51 Rue Richelieu, Paris: August 23, 1823.

My dear Father,—My plan at present is to leave Paris in a fortnight, or at farthest three weeks. Whenever I return

here I shall have the full advantage of the acquaintances I have made. Paris is as come-at-able as Holland, and more so, because any season will do for it: indeed the winter would be preferable to this. If a future opportunity should occur of going to Holland, there will always be many other tours which I could exchange for it—but I only consider it as a route home, and I have already taken most of the others. I am dining now with Ramsay's friends, the Esmenards, a pleasant family. There is only there at present a rich, young, handsome, fashionable, and gentlemanlike American, of Philadelphia, who speaks French admirably. He has a box at the opera, which would be a lounge for me, but my weak eyes almost preclude my profiting by it. He has travelled all over the United States and Canada, and part of Europe; speaks Italian and German, has read some poets, &c., has studied law, but does not intend to practise. He amuses me much. He is an aristocratic republican, well informed, thinks his own the *first* country in the world, and England the *second*, and that the latter would rival, if not surpass his own, if not blemished by the anomaly of a King and a Peerage. I have seen Humboldt often since I last wrote. He said the last time, 'I have just read the last "Edinburgh" and "Quarterly Reviews," and am glad to see in the *latter* two such liberal articles as those on Greece and Spain. To be sure, some may say that the last pages of the latter article are at variance with the first part, but still it convinces me that the majority of your Tories are against the war.' I asked him how he thought the two Reviews had treated him? 'I have no reason to complain, my political opinions are well known, like all others, I have fared accordingly. I was roughly handled by the Quarterly, but perhaps still more injured by the extravagant praises of the Edinburgh. For when they paid me such insidious compliments as to say I was the first of *savans*, &c., they could not fail to make me enemies.' He told me what he thought of many of our great public men on both sides, with whom he has had personal acquaintance.

You will wonder that such simple questions as some in your last letter are not easily answered here, for it is common for a well-informed Frenchman to reply: 'You will

wonder I do not know, but there is no use in learning, for our fundamental laws are changed every few years, and if not, they are violated with impunity.' That the royal prerogative is very undefined here, is, I think, proved by their establishing 'monasteries' and 'taking the veil,' which is in general believed to be unlawful. I have asked, 'Can the king grant a *majorat* to an unlimited amount?' The answer has been more than once, 'If he did, the tribunals, depend upon it, would not overrule it.' The more I learn of the institutions of this country, the more I am convinced that their tendency to absolute monarchy is irresistible. Had we gone to war for the Cortes, we should have, I suspect, thrown the power into the hands of the opposite party, but that power would have remained absolute. But as to the *majorats*, a duke's is 40,000 francs, the other titles less, but I cannot say what as yet. A man's property is divided into as many shares as he has children, and one more, which last (varying of course according to the number of his family) is at his own disposal. For example, if a duke has 340,000 francs per annum, and only two children, he can leave the eldest 240,000 francs a year, viz., 100,000 francs for his share, 40,000 francs for the *majorats*, and 100,000 francs which is at the father's disposal.

You know that Buonaparte introduced a military uniform into the Polytechnic schools, and the scholars were summoned to meals, lessons, &c., by beat of drum. When the Bourbons were restored they abolished this, as inconsistent with establishments intended chiefly for educating youths for civil employments. Within this last three months the drum has been reinstated for the clock, and the military costume for the toga. A cousin of the Esmenards' dined with them on Sunday in uniform. He is intended for a civil department. Schools of *Enseignement Mutuel* were flourishing and multiplying in France. They are now discountenanced, and it is expected will soon be extinct. For these the missionaries have founded 'Schools for Good Christians.' On the high road in the Forest of Fontainebleau has lately been erected an open chapel, with a figure of the Virgin, and candles always burning. When we passed, many women and children were kneeling and praying in it. The churches are

recovering their splendour in Paris, and the priests are most gorgeously apparelled. The congregations are amazingly increased, chiefly because the ministers and persons in power, forming the bulk of their aristocracy, have made church-going so fashionable, that it is becoming contrary to *bon ton* for your carriage not to be seen there. But unfortunately it is still a mark of party, and from my own knowledge I can answer for this fact, that some conscientiously religious Liberals abstain with their families altogether from church, because they have not courage enough to brave the imputation of being place-hunters. But besides their indirect influence, the Government have resorted to open compulsion. For instance, every student of medicine is compelled to produce a certificate of confession before he can take his degree. Fortune does not favour the growth of constitutional freedom in France. Religious feeling is in the opposite scale from that in which it weighed with our ancestors. And this feeling is not extinct as some suppose in France, nor can we ever expect it to be, as it is certainly natural to the constitution of the human mind. At our revolutionary period, the Court and the fashionable civilians were the sceptics, and often the open scoffers. The Puritans were then the church-goers, and Liberals. The Republican leaders in England were able to acquire power to check the Crown by precisely the same hypocrisy by which the modern French Ultras acquire unlimited force for the prerogative.

I have not time to say anything of my last excursion with Prévost to St. Germains, Poissy, Versailles, &c.

With my love to all at Bartley, believe me, your affectionate son,

CHARLES LYELL.

To HIS FATHER.

51 Rue Richelieu, Paris: August 28, 1823.

My dear Father,—I have called twice on Redouté,[2] without finding him.

As an opportunity now offers, I am desirous of seeing the Low Countries, though in autumn, for I think the chances

[2] Botanist, author of *Les Roses* and *Les Liliacés*.

of my seeing Paris again pleasantly are two to one greater than my being able to make a tour in the former in Spring.

Next Spring, for instance, I must hold myself if possible disengaged in order to conduct Prévost to one of our great geological head-quarters in the neighbourhood of Bristol. I hope that Dr. Fitton will escort him to the Isle of Wight, which I know pretty well, and which Fitton ought to visit before he publishes his memoir on part of France.

As I know nothing of the west of England, I shall do myself as great a favour as Prévost. My last excursion with him down the Seine to Triel, by land and by water, was very pleasant, and marvellously economical, for we were three long days, and travelled between twenty and thirty leagues for fourteen shillings each, the whole expense. The aqueduct near Versailles, which crosses a very pretty valley, and conducts part of the water which supplies the palace, is really like the work of a Roman emperor, and well worth visiting. The frescoes of Le Brun, in the palace of Versailles, are very fine, and the chapel magnificent. I certainly never entered elsewhere so kingly a mansion, or any theatre so well adapted for displaying the splendour of a great court. I have little doubt that in the next reign France will (to her cost) see its ancient glory restored, for as a Bourbon is the hero of every painting, it must naturally be a favourite of the family. The revolutionary violence of which it was the scene is considered by the Royalists as having consecrated it, rather than rendered it an object of aversion. As further inquiries have confirmed all the few facts which I have given you in former letters, I am encouraged to send you a few more, which I have from as good authority. When a minister has been dismissed here, he has a pension of about 1,200*l.* per annum sterling, a handsome fortune in France, not only from its purchasing more here, but because it raises a man above the general level than perhaps six times the sum would in England. As the ministers are so often changed, these pensions bid fair to form a large item in the expenditure. If a man votes against the party in power, he is stripped of his pension. This has been done, and if the moderate Royalists had given a patriotic and conscientious vote against the Spanish war,

they would have lost their pensions. As ex-ministers must always form the most able, efficient, and enlightened and useful opposition in a free country, this stretch of power is clearly unconstitutional, and, what is worse, is intended to be such. When Napoleon set up his Senate, he gave every senator 36,000 francs for life. As councillors they were as independent (or ought to have been) as the judges. These senators the Bourbons made peers, with the exception of such as betrayed them during the Hundred Days. A large portion of them were of course as little able to support their dignity as were most of the noble *émigrés* who returned with the present family. To both these classes pensions were assigned, but not, as Buonaparte gave them, for life, but *durante bene placito!* Such a gift certainly neither 'blesses him who gives nor him who takes,' for it so degraded the House of Peers in the eyes of the nation, that since that time it has lost all weight and consideration. The moderate and rational Royalists, who saw the error, proposed as a remedy, either that these noble paupers should be put on the footing of Napoleon's senators, or that a sum be raised by loan, which should be given with a *majorat* attached, and that it should be given to the *émigrés* as a compensation for their losses in the Revolution. The meaning of this latter proposition was to annihilate the hopes of those fanatics who are for laying hands on all the property which they lost at the Revolution. The scheme was regarded favourably by a large part of the Liberals and defeated by the Ultras. The following facts will explain this paradox. You may see every day among the *affiches* in Paris, *Vente des biens Patrimoniels.* This term is used in contradistinction to all those estates which depend on a Revolutionary Title. The latter, even in the height of Napoleon's power, bore an inferior price to the former, and what is curious, the difference between the two varied then, and does still, in different provinces according to the attachment or aversion to the new order of things. Any remuneration to those who lost at the Revolution would cure the Revolutionary titles, and, by raising their value, favour a large and powerful party among the Liberals who hold those estates. This is one reason why the Ultras would not relish

it, but still more because their hopes would then vanish of recovering their lost lands. Their cry is 'All or Nothing!' and for this, as in the war with Spain, they would not scruple to hazard the crown, and risk another revolution.

August 30.—M. Pichon, *Conseiller d'État*, called on me yesterday, and left aninvitation to dinner, but I returned so late from Humboldt's, with whom I spent the afternoon, that I could not go, but I attended a gay soirée there. I had some conversation with him, in which he gave me some entertaining accounts of the state of Parties here. Among other things he said—'Do not suppose that the law of *Equal Division* is the work of Revolution, it was the almost universal Law of France (the nobles only excepted), and is therefore now consecrated by the prejudices of those who love the old as well as the new order of things. The Roman Law, you know, favoured division, and that spread over half France. And the customary law in general favoured it also. I and many others *do not feel sure* that the Law of Primogeniture is not preferable.'

The following speech, which I heard a lady make the other day, is I think characteristic of the ideas which the French entertain, and the manner in which they speak of religion when they are unreserved. 'La Duchesse de Broglie is an amiable woman, very unlike her mother, Madame de Staël, in many points, particularly religion. She is in danger of becoming a complete Methodist, and more so I think since her late tour in England. She will have some influence, too, on that score, on the mind of my old friend the Duke, her husband. When I saw much of him formerly, he had not that turn. I do not mean that he was irreligious, but certainly at that time *he took a philosophical view of things*.'

I have promised Humboldt to pass the afternoon to-day in his study. His new edition serves as a famous lesson to me, in the comparison of England and the Continent. There are few heroes who lose so little by being approached as Humboldt. Of Cuvier this cannot be said.—My dear father, your affectionate son,

CHARLES LYELL.

To His Father.

Paris: September 7, 1823.

My dear Father,—To-morrow morning, by ten o'clock, I shall be off for Compiègne in a '*Clerifere*,' with an order from Duvan, who is Inspector of Public Works, to see the Château. Duvan and I have parted great friends. I have paid at T. and Wurtz's for Hooker's 'Flora Scotica,' which is on its way, and he has given me by way of souvenir La Roche Jacqueline's 'War of La Vendée.' Your roses, &c. from Redonté, I have had packed up with my two boxes of geological treasures by a regular *emballeur*, and they will go from Calais by steam to the Geological Society, where they will be in safety. Your debt to Redonté, which is of three years' standing, I paid—*twenty-four Napoleons*. Although he has made a great deal of money, yet I learn that he has contrived to be poor, and he seemed not a little desirous of touching the coin.

If I had taken up my quarters with the Esmenards on my first arrival, I should have got on very far in French, and it will be a most desirable point to make for on any future occasion. Her husband, in Buonaparte's time, had the administration of the theatres here, a profitable employment, and one which gave them access to the first society, which Madame Esmenard still keeps up. She is very sensible, genteel, and well informed,—in bad circumstances, and rather melancholy, I think for her daughters' sake rather than her own. The eldest daughter paints portraits. Some miniatures also of hers are exquisitely finished. Several of Napoleon and Josephine she has sent to England, and they sold well. As her labours assist the family, she works hard and constantly. She is very amiable. The second is pretty, has reached great perfection in flower-painting, under Redonté, sings moderately, and plays the piano well, *in the French style*. She is unaffected and exceedingly pleasant. The youngest has none of these female accomplishments, and Nature has not favoured her either in form or face, nor I suspect with a contented disposition. She has read, however, the Lord knows how many works, in French, English, and Italian; not to mention that she has dipped

into Titus Livy, with a French translation, and (by way of supplement) began the Latin grammar last month, with an Irish teacher, resident in Paris. Whether the young lady has in truth 'drunk deep of the Pierian spring,' I have had no opportunities of ascertaining, but I can see that the liquor is getting fast into her head, and will, I fear, soon render her d—h disagreeable.

On Saturday week Cuvier introduced me to Professor Van Breda of Ghent, who not only drew out for me a plan of a tour in Holland, but gave me letters to all the Dutch universities, Ghent, Amsterdam, Haarlem, Leyden. He is a friend of Greenough's, who showed him attention in London. As I finish by Ostend, I shall be glad to receive a letter from you there, as well as Rotterdam. I have had full leisure since my stay in Paris to sow all the letters of introduction which I brought from England to French people.

I have not heard of Prévost since he went into the country, so I suppose his wife would not give him leave of absence. I therefore went on Wednesday alone, for a pleasant excursion of three days, to La Ferté-sous-Jonarre, a town situated on the Marne, in a beautiful country sixteen leagues N. of Paris, five beyond Meaux. There are the quarries which supply half Europe and N. America with millstones. They are drawn from the most recent of the Antediluvian Formation, yet in some parts almost resemble the quartz of the oldest granite. They have a simple machine of a lever and a bucket, to draw water out of the pits, by which a boy of twelve years does as much work, I believe, as four men in the marl pits at Kinnordy. It costs but five francs erecting! I have taken a plan and measurement, and cannot but think it could be used with advantage in your loch. The Cathedral at Meaux is a beautiful specimen of the light style of Gothic. My love to all, and believe me your affectionate son,

CHARLES LYELL.

To His Father.

Cambrai: September 11, 1823.

My dear Father,—Although I have not yet advanced far on my route, yet as an opportunity offers, and it may be some time before I have another, I will send you a few lines.

Madame Esmenard asked me one evening 'if I did not think the French had less national prejudices, particularly towards strangers, than the English.' I answered: 'Allow me first to ask whether by English you do not mean those Scotch, Irish, and English, who come from all parts and countries, whereas by French you merely mean Parisians?' After a moment she said, 'I confess I do,' and she defended this by assuring me that their 'provinces were so *behind*, so *prejudiced*,' &c.

Frenchmen, judging from the best-informed and most liberal whom I have seen, when they speak of the spirit, state of feeling, opinion, manners, faults, and virtues of France, merely mean by France, Paris. Mons. Pichon observed to me, 'If there is one thing more than another for which I abhor the memory of Napoleon, it is that he levelled the provinces, and the population of this country, by stripping them of all the municipal rights which they had left: such was his system. There did not remain any occasion on which they could practise "self-government." Throughout France they do not now choose a single alderman or mayor. It has become almost unsafe to trust them with any power, and much restriction which strikes an Englishman as despotic is most necessary.'

The effects of Paris being the centre of the system from which all light and heat emanate, are some of them singular enough. Their numerous judges, I before mentioned, are made subservient by a chain of promotion. Sometimes the President of a Tribunal where the salary is small is raised to another where it is greater, but if it be of the same emolument, and a certain number of leagues *nearer Paris*, this is regarded as a great step. Duvan assures me that there is not a provincial town, not even Bordeaux, which in publishing, and adding to the stock of knowledge, is to be compared to many a small place in Germany of 3,000 inhabitants,

If a man is thought to display talent, he is hurried to Paris, as the only soil where it can be nourished or admired. There are no seats of education of as much consequence as our second-rate public schools out of Paris—*no* scientific establishments, with two or three paltry exceptions, as at Lyons, &c., which seem not to be so much respected as our New Philosophical Society of York, or the Geological of Cornwall. Although the population of this empire is one-third greater than that of the British Isles, there is no Oxford, no Cambridge, no Edinburgh, no Dublin, Glasgow, Aberdeen, St. Andrews, Hertford, Eton, &c. &c.—none of those numerous and often distant points which serve with us to circulate knowledge and the spirit of improvement through the system. Nor can I learn that there is any Gallery of Pictures or Statues, such as Wilton, Hamilton Palace, and a hundred others far and near, which with us enable many a provincial, who has not the time and means to travel to the great central monopoly, to gratify and improve his taste. Paris devours all. A Frenchman may well feel proud of his splendid capital, as worthy of an enlightened nation, and as one of 'the eyes of Europe.' But when we find that in knowledge, science, and in the splendour of wealth, all is a desert beyond, we cannot but regard her pre-eminence as invidious, and suspect that the spot where the court and chief political power has generally resided has acquired greatness at the expense of the other parts. It reminds me of that very original image to which Montesquieu, in his 'Esprit des Lois,' likens a despotic government, which he says resembles that custom of the savages of Louisiana, who, in order to get at the cocoa-nuts, first cut down the tree. I have met, however, with so many liberal thinking and moderate men of both parties in Paris, that I expect France will work out for herself a better order of things. There is always hope while the representative system remains, and liberty to publish their debates; and I hear that Labourdonay and many Ultras, who would tear the Charter in pieces if they could, set off as soon as the session ended, to labour to acquire influence in their provinces. This is well, and must raise up the provinces soon.

My love to all, and believe me your affectionate son,

CHARLES LYELL.

[M. Constant Prévost visited England in 1824, and Mr. Lyell made a tour with him from London to Bristol and the Land's End, returning by the southern coast to Hampshire, in the course of which they were entirely engaged in geological investigations.

In the summer, Mr. Lyell made another geological tour with Dr. Buckland in Scotland, who accompanied him from Kinnordy to Aberdeen and Inverness, and they paid a visit to Sir George Mackenzie in Ross-shire, and after crossing the Grampians, visited Sir James Hall at Dunglass.]

To Gideon Mantell, Esq.

29 Norfolk Street, London: February 17, 1824.

My dear Sir,—Your very obliging present of the 'Outlines of the Geology of Lewes' came to me almost as a reproach for having so long delayed sending you my letter on the Isle of Wight, which I ought to have returned to you long before. Your little volume is a very elegant illustration of your native town, and your contribution to it is an excellent proof how much the sphere of local interest is enlarged by geology. A few years since, a history of Lewes would scarcely have yielded any glimpse of information so far back as the seventh century. The Geological Antiquarian can safely rank his treasures of the youngest date as of an age of which the builders *of your old castle* had no traditionary knowledge.

W. D. Conybeare [3] is in town, and has been with us for some time. He is waiting for the arrival of the new Lyme Regis Plesiosaurus, of which he has an excellent drawing. The Duke of Buckingham has bought it, but it will be exhibited for some time at our rooms, 20 Bedford Street. It affords a great anatomical triumph to Conybeare, as most of his hypothetical restorations in his former memoirs turn out true to nature. The new animal is a very perfect skeleton, and a prodigy, for it has forty cervical vertebræ, whereas existing quadrupeds range from seven to nine, reptiles from three to nine. Aves reach no higher than twenty, the swan being the maximum. What a leap have we here, and how many links in the chain will geology have to supply.

Believe me, very truly yours,

Charles Lyell.

[3] Rev. William Conybeare, Dean of Llandaff, geologist, b. 1787, d. 1857

To HIS FATHER.

Bristol: June 6, 1824.

My dear Father,—I arrived here on Saturday with Mons. Prévost, after a very pleasant tour. We went to Gloucester and to Falfield, sixteen miles on the road to Bristol, where I called on Dr. Cooke at Tortworth Rectory. The Rector was not at home. By good fortune, however, his friend Mr. Weaver, a member of the Geological Society, who has made himself very eminent by his writings, was staying there, and keeping house. He received us with the greatest cordiality, made us breakfast and dine there for two days, and gave us more information than I had ever received in the same time. The Rectory is the most beautiful and picturesque spot in the world. It stands, like Airlie Castle (to descend from the sublime to the geological), on the Old Red-Sandstone Conglomerate, and on proceeding northwards all the beds which the Isla present are formed in succession, in particular the Cortachie slate, which contains organic remains here, proving it to belong to the transition-limestone series. The identity of these beds, so carefully studied here, throws such a light on Forfarshire, that my tour has been inestimable to me, were it merely for that, more particularly as Maculloch, not having compared this portion of English geology with Scotland, has no suspicion of it. The calcareous part, which unfortunately for us is wanting in Scotland, happens to be feeble at Tortworth, and this helped to make the analogy more striking to me. We came from Tortworth to Bristol, where Mr. Conybeare had been expecting us for three days. I do not expect to get farther west than Plymouth. Prévost's Norman paper attaches him to the Oolites chiefly, and makes him unwilling to approach the more ancient formations.

He is so good a naturalist, that I shall learn much from him. He is wonderfully struck with the beauty of our roads and stage coaches in England. This town looks dull, though I believe the commerce is thriving moderately.

With my love to all, believe me your affectionate son,

CHARLES LYELL.

To Gideon Mantell, Esq.

Bartley Lodge, Southampton : July 9, 1824.

My dear Sir,—The three letters which you have sent me, and which are still unanswered, arrived in town when I was absent on a tour with Mons. Constant Prévost, a French geologist whom you know from his works.

I am glad you are persevering in enriching your collection, which is becoming generally celebrated, and will soon be more known since the visit of our Oxford Professor, who was much struck with it.

My friend Prévost studied anatomy for three years, under Cuvier, and as he is intending to visit England again this summer, he will if possible call on you at Lewes. I gave him your address, and assured him that he would meet with a welcome from you. It would be of use to his geological work in Normandy to see your fossils, and I doubt not you will derive much light from his remarks on your osteological treasures.

Three weeks since a magnificent specimen of an Ichthyosaurus (tenuirostris?) was discovered at Lyme by the celebrated Mary Anning. It is about the size of the Plesiosaurus which you saw in town. M. Prévost took a drawing of it, which I have traced, and I send it you, that you may see it, as it will be long probably ere it is published. The sketch was taken by measurement, and, although rapidly, yet may be depended upon. While we were at Lyme we witnessed the discovery of a superb skeleton of Ichthyosaurus vulgaris, by Miss Anning. It was perfect, save the tail, which a cart-wheel had passed over. It was two feet long.

Believe me, yours very truly,

Charles Lyell.

To His Father.

Airlie Castle : August 10, 1824.

My dear Father,—I rode with Chambers[4] round the plantations. They have all received a check by the severe winter of 1822-23, which is evident. As the top of the

[4] The gardener at Kinnordy.

Castle Hill is so prominent, it would be worth while to take out the few Scotch firs, and substitute healthy young larches, which, if they do not grow so high, will still be lifted above the rest of the wood. I went through the peat moss, the draining of which proceeds rapidly. The number of wasps in the garden is unprecedented. Chambers has accordingly introduced 'commissioned bottles,' *i.e.* bottles made expressly by his direction, eight dozen of which are emptied every two days, full of dead wasps, but 'the plague,' he says, 'is unabated.'

I am obliged to finish this letter before breakfast, and have scarcely time to tell you of my ten days' tour with Captain Ogilvy, which was most successful, and puts the geology of the county in a new light, as little suspected by Blackadder or Maculloch. The Siedlaws are what Werner termed 'a saddle,' the stratification being this, the older beds in the centre, flanked by younger ones; but what is still more interesting, the centre beds are the same as appear on the Isla between Airlie Castle and the Mill of Craig, or between Kinnordy and Catlaw.

The discovery of the New Red Sandstone explains many anomalies which Dr. Fleming made by confounding it with the Old. We went by Dundee, Arbroath, and Lunan Bay. I drew the whole coast from boats, and we examined it thoroughly, not stopped by rain a single day. Paid a visit at Tannadice on our way back. Lord Airlie arrived here last night, and is going to shooting quarters forthwith. Left all well in Paris except Mrs. Drummond. He has given Glen Moy [5] to Sir J. Ogilvy and me, but I shall begin with Balentore.[5]

Believe me, your affectionate son,

CHARLES LYELL.

To HIS FATHER.

Kinnordy: September 6, 1824.

My dear Father,—I am much obliged to you for having shown my friend Prévost an English race-course. On Tuesday morning I set out with Drummond, to the North Esk.[6]

[5] Shooting quarters.

[6] Thomas Drummond, botanist. Went to North America as assistant

Went by Hill of Careston, from which there is a glorious view of the Strath. I lodged at the shooting quarter, an inn of Maule's at Gannachy Bridge, close to the burn. Made myself master in four days of the grand succession of strata seen between Gannachy and the granite of Mount Battock, from the summit of which the view is very fine. We saw Aberdeen well, Loch na Garr, Ben Macdui, Cairngorum, &c. I improved myself much in geology, and Drummond also, who knew nothing, but was very anxious for a cram. The weather was delightful. I was to have gone to Airlie Castle yesterday, but begged off a day in order to arrange my concerns. I drive there to-day, and we are then to examine the Ericht from Blairgowrie upwards (perfectly unexplored ground), and then on Friday to dine together (the captain and I) at Pearsie, and stay a day or two there. I have received a most friendly letter from Buckland, in which he tells me that he has just finished his expedition to the Hebrides, and wishes me to accompany him on a visit to Sir George Mackenzie's at Cowl (in Ross-shire ?), and on a short tour, by Aberdeen, Inverness, down Loch Ness, Fort Augustus, &c., all to take less than *ten days*. He offers to make his time in some measure suit mine. I have chosen within two days of what he proposes, and have told him he must spend one day here, that I may show him the place, and also some specimens on which I have doubts, besides my map, &c. It will be I expect about the 15th of this month. I look forward to no small amusement in being ten days with him, when he is so full of new matter, as he must be after a visit to the Western Isles, so interesting and disputed a field for geological inquiry. On Saturday a pair of antlers were taken out of the marl two feet deep in the loch here quite perfect and of uncommon beauty. The frontal bone is entire, and supports them well. They have nine points or branches, and measure more than ten inches round in the thickest part. It will be a great ornament to the house. Some of the jaw and teeth were found also. The loch also produced me a fine dish of fish for dinner yesterday. There is a great sale of marl this year. Among the speculators

naturalist to Dr. Richardson, under Sir John Franklin, and afterwards collected plants in the southern United States, and died at Havannah in 1834.

who are investing their capital in buildings in the New Town of Kerry, on the South Muir, is Mr. John Chambers, forester at Kinnordy.

Your affectionate son,

CHARLES LYELL.

To HIS SISTER.

Cowl, Ross-shire: September 26, 1824.

My dear Eleanor,—A fall of snow, which has surprised the good people here in the midst of their harvest, gives me an hour's leisure to write to you, in answer to your account of the Salisbury gaieties, for which I have to thank you. We arrived here yesterday morning from Inverness, and shall probably quit it to-morrow for Brora in Sutherlandshire, where my companion has an interesting point to examine, otherwise we might both find no small entertainment here for a longer stay, as it is one of the most delightful houses I ever visited. Sir George Mackenzie took a long walk with the Professor and me, both yesterday and to-day. He is very gentlemanlike and intelligent, and full of information. He was very desirous to show Mr. Buckland a set of parallel roads on the small scale in a valley here, and was evidently astonished with the rapidity with which the Professor seized all the facts, and gave a most excellent theory to account for them. They will make a pretty figure in the second volume of the 'Reliquiæ Diluviæ,' which Mr. Buckland is just going to publish. The country here is very beautiful, the hill scenery picturesque, particularly at the present moment, when Ben Wyvis and the higher hills are covered with snow. There are some of the largest oaks near the house that I have yet seen in Scotland, and the hills are clothed with birch to some height. The house is new, and does credit to Sir George's taste. We have of course been looking over our host's magnificent collection of mineralogical treasures from Iceland. But his present hobby is vitrified forts, on which he has advertised a work, in which he is to attack Dr. Maculloch. Lady M. is a very ladylike woman, and her two daughters pleasant girls. They have four or five sons of all ages. We

are to have Lord Pitmilly, one of the Scotch judges, to dinner to-day, who is on the circuit. But I must now beg leave to treat you with a little retrospective history of my adventures. Mr. Buckland was so desirous of clearing up some puzzles which presented themselves on the banks of the Carrity near Kinnordy, that he agreed to see the Isla, and as this was found more than a day's work, we accepted Captain Ogilvy's pressing invitation, and dined and slept at Airlie Castle, and finished the Isla and Melgum next day, and after dining again with Captain O. returned to Kinnordy, and started next morning for Stonehaven. Saw Dunnotter Castle the same evening, and next day boated it to Aberdeen, and saw the termination of the Grampians in the sea cliffs. At Aberdeen we were in high luck, for Dr. Knight, Professor of Natural Philosophy, was an acquaintance of Mr. Buckland's, and invited us to go with him to an annual dinner, at which we saw the Principals of the two Universities, Dr. Jack and Dr. Brown, and all the Professors. The next morning we breakfasted at Dr. Knight's, then dined with Dr. Forbes, Professor of Natural History. The Duke of Gordon, Chancellor of the University, was there, an old man of eighty, not at all superannuated, and well worth seeing. We attended the same day the assizes, and heard the Chief Justice Clerk condemn a thief for burglary. The next morning we breakfasted with Dr. Glennie, Professor of Moral Philosophy, a clever man, married to the niece and representative of Dr. Beattie the poet. There is in their room a most beautiful portrait of Dr. Beattie by Sir Joshua Reynolds, which has kept its colour. After seeing everything worth examining in geology at Aberdeen, we left it in company with a young advocate, son of Sir J. Hall, an acquaintance of Buckland's, who left us the day after. He was an agreeable addition to our party, as far as he went, viz. to Peterhead, from whence to Cowl I have little to speak of, as we passed it rapidly, but Portsoy, Elgin, and Inverness presented us with some things worthy of notice.

I have no more time save to hope that, when I return to Kinnordy a week hence, I shall find papa and Tom arrived. In the meantime, believe me, with my love to all at Bartley, your affectionate brother, CHARLES LYELL.

To His Mother, at Bartley Lodge.

Edinburgh: October 18, 1824.

My dear Mother,—In my way through Perth I learnt that my father was expected at Kinnordy on the eleventh. I conclude, therefore, that he is now there, and take an opportunity of giving you some account of my proceedings since I left Cowl. Mr. Buckland went from Ross-shire to Brora in Sutherland, and in examining that district we got within a moderate day's journey of John O'Groat's House. We then returned to Inverness, and travelled thence, in a gig, along the Caledonian Canal, by the Fall of Foyers and Fort Augustus, then visited the parallel roads of Glen Roy beyond Letter Finlay, one of the grandest natural phenomena in Great Britain. We next went by Glen Spean, Dalwhinnie, and Dalnacardoch to Blair Athole, with which and Glen Tilt we were much pleased. We then came by Killiecrankie and Perth to Edinburgh. Here we have worked very hard for a week in the geology of the neighbourhood, and in cabinets, museums, &c., and have had an excellent opportunity of seeing all the leading characters in the University. We have been at breakfasts and dinners without end, at Professor Jamieson's twice, at Professor Wallace's, Dr. Hibbert's, Mr. Allen's, four times, Dr. Greville's, &c. &c.

From Edinburgh we made a geological excursion with Dr. Hibbert to Linlithgow, Falkirk, and Stirling, which proved very successful. We then went to Dunglass, Sir James Hall's,[7] a very elegant and stylish place, about eight miles from Dunbar. The old gentleman is far past his prime, but luckily Captain Basil Hall, the author of the 'Voyage to South America,' was there, whom I had often met in town. He is one of the most gentlemanlike and clever men I have ever met with. We made some great expeditions to St. Abb's Head and other parts of the coast with Sir James and his son, and a Mr. Allison, advocate, on a visit there. Lady Helen Hall is daughter of the late Lord Selkirk; the two unmarried daughters are very pleasant, one of them very pretty. We came home yesterday morning in order to spend

[7] Natural Philosopher, b. 1760, d. 1832.

the forenoon and dine at Craig Crook Castle, the country house of the far-famed Francis Jeffrey.[8] This was a great treat. He is a little man, of very gentlemanlike appearance and manner. Shines in conversation, whether on trifling or important topics. After his showing us round the grounds and neighbourhood, we met at dinner, Sir H. Parnell, M.P., and Mr. Murray, and others. The dinner and wine in great style. Among others at the dinner was Mr. Maculloch, who gave the celebrated lectures on Political Economy in town last summer, which I attended. He was an acquaintance of mine, and pressed me to dine with him to-day, which I am to do. I expect much amusement from the party. Mr. Buckland left this to-day for Alnwick Castle. I return to Kinnordy to-morrow.

With my love to all, believe me, my dear mother,

Your affectionate son,

CHARLES LYELL.

[8] The eminent critic, editor of the 'Edinburgh Review,' and, later, one of he judges in the Court of Session, Scotland.

CHAPTER VII.

JULY 1825—DECEMBER 1827.

CLATHRARIUM LYELLI—ENTOMOLOGY—LOCKHART BECOMES EDITOR OF THE 'QUARTERLY REVIEW'—BREAKFAST AT LOCKHART'S WITH SIR WALTER SCOTT—VISIT TO CAMBRIDGE—PLEASURE IN READING LAMARCK—PLANNING HIS FUTURE WORK—ON INTOLERANCE IN SCIENCE.

[Mr. Lyell's eyes having become stronger, he resumed the study of the law at his father's request, and was called to the bar in 1825, and went the Western Circuit for two years. He published a geological paper in Brewster's 'Edinburgh Journal of Science' on a dike of Serpentine cutting through Old Red Sandstone in the county of Forfar, which is perhaps one of the best examples of Serpentine in this country, with all its characteristic mineral peculiarities intruding itself in the manner of trap in the sedimentary strata. A paper on shell marl, and fossil fruit of Charæ, was printed in the Transactions of the Geological Society this same year.

In 1826 he became a Fellow of the Royal Society, and he wrote papers on the Plastic Clay near Christchurch in Hampshire, and on the freshwater strata of Hordwell Cliff, Hants.

His family left Bartley Lodge in the New Forest, Hants, to reside at the family seat, Kinnordy, Forfarshire.

In 1827 Mr. Lyell wrote in the 'Quarterly Review' an article on Scrope's 'Geology of Central France,' in which he showed how entirely he had imbibed the opinions of Playfair and Hutton, and considered that all geological monuments were to be interpreted by reference to aqueous and igneous causes in action in the ordinary course of nature.]

CORRESPONDENCE.

To GIDEON MANTELL, ESQ.

Bartley Lodge, Southampton: July 20, 1825.

My dear Sir,—I went to Fitton's when he came to town for a few days in the beginning of this week, and was not a

little gratified at being there when the Clathrarium, my namesake, was found.[1]

You might have felt secure that so beautiful a specimen as it really is would never have been thrown away even by mistake at the house of a geologist. Though I did not see Chantrey[2] about the Iguanodon's teeth, yet I have no fear of their safety, and that they will at length in his hands, like the teeth of Cadmus's dragon, be productive of a fruitful crop. Fitton has promised to inquire about them. He has just returned from examining the 'Valley of Elevation,' as Buckland calls it, at Highclere, which I consider as caused by a continuation of that elevating force which acted in a line along the central axis of your great saddle of Surrey, Kent, and Sussex, and which, if prolonged, would have elevated the firestone beds (for such they prove to be) at Highclere.

All this took place after the deposition of the London Clay, and before it happened, the Plastic and London Clays of the Hants and London basin were horizontally connected. The chalk which now separates them was pushed up through them, for, as Buckland observes, the highest chalk summit at Inkpen Hill is still covered by decided Plastic Clay. Your great valley is not a valley of denudation. I do not agree with Buckland that much chalk has been carried away between the north and south downs, for as two sides of a triangle must be longer than the base, so when the horizontal chalk was inclined from below London to the north downs, and again from Lewes to Heaven knows how many miles under the sea, how could there be other than an opening of some miles?

I remain here for a month or more, and perhaps may go to Dresden to learn German this summer, or rather autumn, but I am not sure. Buckland, you know, is made by Lord Liverpool a canon of Christ's Church, a good house, 1,000*l.* per annum, and no residence or duty required. Surely such places ought to be made also for lay geologists.

Believe me, yours very truly,

CHARLES LYELL.

[1] Clathraria Lyelli, a fossil plant from the Wealden in Sussex. See Mantell's *Medals of Creation.*

[2] Sir Francis Chantrey, sculptor.

To His Sister.

November 20, 1825.

My dear Marianne,—As chief keeper of the Bartleyan or Lyellian Entomological Museum (for when we talk of small things we should help them up with high-sounding names) you may fairly expect me to report progress. The treasure I brought to town remained peaceably in my cupboard till the first evening meeting of the Linnean Society, when I took in my pocket the small mahogany box, and you would have been amused to see the greediness with which the collectors examined two or three good things, and Curtis [3] was congratulated on having met with one so easily pigeoned, for I told him to help his collection if he could. I afterwards took him the other moths, and you will be glad to hear that one small buff *Noctua* filled a chasm in his collection (*N. Flavilinia*) not in Donovan. He told me once that nothing was wanting in his that was not worth a guinea. But the grand treasure is a new moth. Which think you? That ugly black *Noctua* of the size of *Gamma* with white petticoats (*alias* under-wings), which 'you and the other slaves of the lamp' caught one night. I left at least one more of them at Bartley. This I conceive was a guinea one. I have given it to Curtis, and in return he presents us with *Sphinx Tilea* and many moths, and promises much more in payment besides naming them all. But he says there are so few collectors in Scotland, that if you choose to collect, without ever going out of the garden at Kinnordy, you may purchase with Forfarshire *Phalænæ* an English collection worth many hundred pounds. Curtis found so many things in Scotland last year, that he talks of publishing an account of his cruise. The number of collectors of British Lepidoptera in town is very great, and makes an extensive barter of Scotch insects the easiest thing possible. Of the latter, 30 new Lepidoptera were found by Curtis last summer, but in England, though they have 1,500 species, they seldom get a new one, even a minikin.

With my love, believe me your affectionate brother,

Charles Lyell.

[3] John Curtis, Esq., F.R.S., author of *British Entomology*.

To His Sister.

London: December 4, 1825.

My dear Eleanor,—I really wish that some of you, or all of you, would write to me now and then. To confess to you the truth, I have been a little homesick since in town, and after spending six very agreeable weeks without a grievance at Bartley, I have missed the sight of a friend's cheerful countenance till last week, when the Fittons, Buckland, and Dr. Daubeny and Scrope,[1] came to town. However, I have given in my resignation as Secretary for the end of the year, and will revenge myself on Greenough & Co. by an additional week if possible at Bartley at Christmas. Coleridge informed me yesterday that he has given up the Quarterly, and that Lockhart comes from Edinburgh in a week to take it. He could not get my paper into his last number, but would have put it into the next, with certain parts abridged. He showed me how Gifford formerly cut to pieces his papers, and this encouraged me much. Indeed, had I been aware how difficult a task even for such a man as Coleridge it had been to fit an article for the Review, I should never have presumed to write. I have at all events made Coleridge's acquaintance, and though I expect to be wrecked in the attempt to pilot myself into the graces of a new editor, I shall not be ashamed with such encouragement to run the gauntlet. Scrope wants me to pay a visit to Waverley Abbey, but I shall not go, at least at present. He is a clever, gentlemanlike man of fortune, of my own age, and has just published a very creditable work on Volcanoes.—Ever your affectionate brother,

Charles Lyell.

[1] George Poulett Scrope, son of G. P. Thomson of Waverley Abbey, b. 1797, d. 1875. He showed an early taste for geology, and adopted Hutton's doctrines. Author of *The Geology and Extinct Volcanoes of Central France*, and other works.

To G. MANTELL, ESQ.

Temple: January 3, 1826.

My dear Sir,—I have received your book and paid for it, which I hope your subscribers will do more punctually than Macculloch swears his do.

Your eulogium on my 'profound legal knowledge,' though a severe quiz upon me, has not been quite so much a subject of amusement to my friends as I anticipated. Buckland, however, was not a little merry yesterday at my expense. I told Murchison not to laugh too freely, for I should get you by way of a set-off to omit it in the second edition, and to substitute for it 'but more particularly to Mr. Murchison, Sec. G. S., whose scientific acquirements, no less than his splendid military achievements in the Peninsula under the Duke of Wellington during the late war, are so well known and appreciated.'

Buckland has got a letter from India about modern hyænas, whose manners, habitations, diet, &c., are everything he could wish, and as much as could be expected had they attended regularly three courses of his lectures.

Yours very truly,

CHARLES LYELL.

To G. MANTELL, ESQ.

9 Crown Office Row, Temple: June 22, 1826.

My dear Sir,—I much regret missing you, particularly as I had just got a copy of my paper ready for you. I live near my old rooms. Do not talk of the G. S. As long as Warburton allows the whole to rest on his sole shoulders, and has a large mercantile business, and a hundred other hobbies besides the principal one, the London University (to which is now added M.P. for Bridport), so long publication or real utility is out of the question; and a secretary might as well try to bring about reform, as Warburton in his new capacity to throw open all the rotten boroughs. But enough of this. I must not sport radical, as I am become a Quarterly Reviewer. You will see my article just out on

'Scientific Institutions,' by which some of my friends here think I have carried the strong works of the enemy by storm. I am now far on with a second, and hope to get it out in less than three months. I mean to help myself out of Cuvier largely, for I must write what *will be read.* The Plesiosaurus is delightful, so is Stonefield and Cuckfield. If you can send me comments on Buckland, I will use them delicately : also say how much of the great skeleton you have now got together. I would give eight or ten lines to your Museum—more I hardly can—if you would put down on this osteological topic any fact that is marvellous, also anything about the vegetation that you have gathered from Ad. Brongniart. This would come in in another place.

I am over full of work, so believe me yours faithfully,

CHARLES LYELL.

To HIS FATHER.

Temple, London : November 16, 1826.

My dear Father,—My breakfast with Lockhart this morning was exceedingly pleasant. Sir Walter Scott is in the first place a far more genteel-looking man than Phillips has represented him in his portrait, which, as I had supposed that to be flattering, surprised me considerably. His *hobbling* was much greater than I had fancied. There was only his daughter, Miss Scott, Mrs. Lockhart, a Dr. Gooch, King's Librarian, and a Dr. Macculloch, a medical man. Sir Walter was very cheerful, told a number of good stories on subjects always started by others. They were more remarkable for the rich fund he had of them, than for anything else. None of them were brilliant, but all pleasant. For instance, a Mr. Simpson was talked of. 'Ah, how is Jemmy? I shall not forget his coming into the theatre just as Mrs. Siddons had entered her box, and been received by a round of applause from the audience. Jemmy, seeing no one on the stage, inquired the cause. "It is a mark of esteem and consideration the public have for you, Mr. S.," said a friend. Jemmy went to the front of his box and made three low bows, to the infinite amusement of all who knew him.—Now

that was a cruel joke.' His language is remarkably far from being refined, there is positively a blunt simplicity in it. 'The French,' he said, 'are certainly in better humour with the English than formerly—we are *up* there.' When the increasing Catholicism was talked of, he said, 'I think it will not go beyond a party, but I wish the royal family may not run their heads against that thing.' He said, 'Yesterday I was at Chantrey's, and recommend you all to go and see his statue of Washington.' Lockhart said, 'As portrait-painting is so profitable, I wonder there is not one good painter now but Sir Thomas Lawrence.' I observed 'Phillips has surely painted some excellent portraits.' Sir Walter replied, 'Yes—but Phillips is quite a hit and miss man.' Sir Walter declared himself no judge of the art, but went on making some curious remarks on the peculiar difficulties painters now labour under, compared to the great masters of old, and added, 'I have seen a great advance in the English school since I remember.' Mrs. Lockhart is a very agreeable person. Lockhart sent me a paper in slips the other day on our 'Public Schools,' to ask me my opinion. I rewrote some passages relating to the introduction of elementary information in Natural History, &c, which he has adopted, as well as other suggestions. My plan is now to write an article next number but one, on 'Scotch Universities,' or our whole system in Great Britain and Ireland, which I begin to hope I shall master. In the number after a Geological article, already on the stocks; and then, if I can manage it, a shorter paper on our Scotch and English scientific journals, and Scotch and Irish scientific institutions.—Believe me your affectionate son,

CHARLES LYELL.

To HIS SISTER.

London: January 5, 1827.

My dear Marianne,—I am glad to hear that, notwithstanding a tiger broke loose,[5] so little damage was done in the menagerie. I hope that the first week the house is free

[5] In the insect box.

from company you will proceed not only to arrange, but to reset everything that stands at all in need of it, for I can promise you that unless you get on you will have more on your hands than you can manage when Curtis's next box, with a certain arrival from another quarter, which I have just heard is on the road, reaches you. I staid with Spedding[6] a week at Cambridge, at Trinity Hall, learnt much from Professor Henslow[7] and his friends, to whom he introduced me, about the Cambridge system, for my paper; made an agreeable acquaintance in Marmaduke Ramsay, brother of Sir Alexander Ramsay, a gentlemanlike Fellow of Jesus. Grand festivities at Trinity Hall and St. John's, great dinners, suppers, and male routs. I paid my expenses by what I won at whist, though I revoked one night! Copley,[8] Master of the Rolls, was at Trinity Hall, most excellent company. He conversed easily with every one, and upon my mere general introduction there, he talked with me when we met at other colleges. Lord Palmerston made me a stiff bow, the contrast of his manner to Copley was entertaining, for his was a perpetual canvas and acting a part. He said that Dr. Spürtzheim (who has lately lectured at Cambridge) was 'an ingenious humbug,' which is just what most men, even his supporters, think of him at the University. One night, when I went to hear the Hymn at Trinity Chapel, I fell in with William Ramsay of Bamff, in his surplice. The new buildings are beautiful, and will immortalise Wilkinson the architect. I begin to think I must divide my article into two, and write the first chiefly on the English universities. If Lockhart cannot stand it, I will try Jeffrey. I am going to Devizes Sessions on Monday next, three days' work. I think you will get more chilblains than colymbetes in the loch in winter. When you fish there take shells also, as I should publish a list in some future marl paper. When I called yesterday on Mrs. Smythe,[9] I caught her making an abstract from La Place's 'Astronomy' of those facts and speculations which could be made intelligible to persons not mathematicians. Her selection is so beautiful and striking,

[6] T. S. Spedding, of Mise House, Cumberland.
[7] Professor of Botany.
[8] Afterwards Lord Lyndhurst.
[9] Wife of Admiral Smythe.

that when it is finished I shall get a copy. Professor Henslow says that the Cambridge and Huntingdonshire marshes swarm in some seasons with *Machaons* and *Lycæna dispar*, and he will get me some. He showed me a good beginning of a collection of British insects at their Philosophical Society.

Your affectionate brother,

CHARLES LYELL.

To G. MANTELL, ESQ.

London: March 2, 1827.

My dear Sir,—On my return from the circuit yesterday I found your second letter, having received the first with Lamarck at Dorchester. You know that half my time is now spent at Sessions, Circuits, &c., and must not therefore be surprised when you receive no immediate answers to your correspondence, which I always receive with great pleasure. I devoured Lamarck *en voyage*, as you did Sismondi, and with equal pleasure. His theories delighted me more than any novel I ever read, and much in the same way, for they address themselves to the imagination, at least of geologists who know the mighty inferences which would be deducible were they established by observations. But though I admire even his flights, and feel none of the *odium theologicum* which some modern writers in this country have visited him with, I confess I read him rather as I hear an advocate on the wrong side, to know what can be made of the case in good hands. I am glad he has been courageous enough and logical enough to admit that his argument, if pushed as far as it must go, if worth anything, would prove that men may have come from the Ourang-Outang. But after all, what changes species may really undergo! How impossible will it be to distinguish and lay down a line, beyond which some of the so-called extinct species have never passed into recent ones. That the earth is quite as old as he supposes, has long been my creed, and I will try before six months are over to convert the readers of the Quarterly to that heterodox opinion. I should like to discuss these matters with you at Lewes, but between law excursions and town studies, I have

never a moment to spare. If ever I can I will, and give you notice, and can assure you, that I know I shall receive a welcome, and you need not, therefore, repeat your kind invitation.

I wish among your new Groombridge fossils there had been a good cetacean, for theoretically it would be of more importance than the iguanodon. Not that I doubt some of the oolitic cetacea. I am going to write in confirmation of ancient causes having been the same as modern, and to show that those plants and animals which we know are becoming preserved now, are the same as were formerly. *E.g.*, scarcely any insects now, no lichens, no mosses, &c., ever get to places where they can become imbedded in strata. But quadrupeds do in lakes, reptiles in estuaries, corals in reefs, fish in sea, plants wherever there is water, salt or fresh, &c. &c. Now have you ever in Lewes levels found a bird's skeleton or any cetacea? if not, why in Tilgate and the Weald beds? In our Scotch marl, though water birds abound in those lakes, we meet with no birds in the marl; and they must be at least as rare as in old freshwater formations, for they are much worked and examined. You see the drift of my argument—*ergo*, mammalia existed when the oolite and coal, &c., were formed. Broderip[1] says, that in spite of all the dogs and cats which float down the Thames, none of their remains have been found in recent excavations in the Thames deposits. Send me your thoughts on the subject. If I am asked why in coal there are no quadrupeds? I answer, why are there none, nor any cetacea, nor any birds, nor any reptiles in the plastic clay, or lignite formation, a very analogous deposit, and as universal in Europe? Think of these matters, and believe me yours most truly,

CHARLES LYELL.

To HIS FATHER.

April 10, 1827.

My dear Father,—I was glad to hear this morning from Kinnordy, as I had had no news since you were snowed up. Leonard Horner is in town from Edinburgh, very *à propos* to

[1] William John Broderip, zoologist, especially devoted to molluscous animals, died 1859.

keeping me right in my article, as he is a great education man, as well as geologist. His gratitude to me for having got into the 'Quarterly Review' an article on the liberal side of geology is very agreeable. He is eager to serve me, and wanted me to let him go carefully over the article, with his friend Brougham, which I begged him not to do, as Mr. Brougham might make a good joke out of revisals of 'Quarterly Review' articles. Horner himself is a safe man. Brougham had second business, next to Scarlett, this last circuit, a fine thing. He has published two pamphlets which I have not read, one 'On the Pleasures of Education to the Poor,' and the other on Hydrostatics, which are having a prodigious sale: they talk of ten thousand copies going off in a short time. Scrope has just published a volume on Auvergne, with beautiful panoramic and geological views of the country. As I am, with many others, indignant at an atrocious article which Macculloch[2] wrote on his late work on volcanoes, in the Westminster, I am determined to give him a moderately long article in the 'Quarterly Review,' a sort of abstract which I conceive will take one-fourth the time of an original article, and the latter, as far as science is concerned, should not be, I am clear, given to a periodical. All that Fitton means, can be done easily in an elementary book, like Mrs. Marcet's 'Conversations on Chemistry,' for which one might get well paid, without much credit, and without putting one's name, and which is greatly wanted. But if I wrote anything, I would wait longer (unless I was in want of cash), and certainly a work even elementary, which would gain one reputation, would neither be done in a few months nor easily. I have my doubts as to leaving sessions on the score of economy. I found the additional time of which I am master, in consequence of ostensibly following a profession, is very great, and perhaps the 30*l.* that sessions cost me, might be annually returned by an additional article, which I might be thereby enabled to write. It is wonderful how little mercy one's friends have on one's time, if one has no excuse deemed valid for declining unprofitable parties, or refereeships of papers, or secretaryships, &c. The circuit

[2] Author of *Description of the Western Islands of Scotland*, and other works.

costs under 50*l.*, everything included. My purse would not have required replenishing for some time, but I am much obliged to you for anticipating my wants as usual. I find them diminish monthly, in proportion as I am more agreeably employed, and if with the willingness to work and industry which I now have, I had any chance of earning what I require by my own exertions, I should be without a care, as far as I am myself concerned. But to be willing without avail to work hard, and almost for nothing, is now the fate of many hundreds of barristers, and many millions of our labouring classes, and we must congratulate ourselves at not being among the latter. I am quite clear, from all that I have yet seen of the world, that there is most real independence in that class of society who, possessing moderate means, are engaged in literary and scientific hobbies; and that in ascending from them upwards, the feeling of independence decreases pretty nearly in the same ratio as the fortunes increase. My eyes go on tolerably, and I feel my facility of composition increases, and hope to make friends among those that a literary reputation will procure me who may assist me.

Believe me, your affectionate son,

CHARLES LYELL.

To HIS SISTER.

1827.

Dear Marianne,—Curtis sends me a note to say that there are good things among the Spring insects, and says the Miss Lyells will do wonders in Scotland. He hopes you will get some general knowledge of botany, as a little knowledge even of the wild Scotch plants would, he says, double the value of your entomological information. It is a singular proof of how much more is to be done in entomology in North Britain than in botany, that Curtis found in his excursion last summer in Lepidoptera alone thirty insects new to Britain, and some quite unknown and new; while Dr. Hooker has never found more than, how many plants? not ten, I think I recollect. You will be glad to hear that Mr. Vigors has sent five specimens of the clear-winged Sphinx

'tulipiformis' and a great many *Nocturna* and *Coleoptera*, &c., all named, as a present to our collection. I told him that Curtis was to have the first picking of whatever you got in Forfarshire, to which he said, 'I was once in Edinburgh, and collected only for two days in June, and I would give all my duplicates for half the things I got in those two days.' I met with the Rev. D. Cooke, nephew of the geologist. He says when he next sends to Curtis he will send for us that beautiful insect *Carabus nitens*, and wants from us *Chrysomela Banksii* in return, of which you should send up four the first opportunity,

Your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Temple: December 9, 1827.

My dear Caroline,—Captain Smythe[3] called here, in town for a few days. Mrs. S. and family quite well, and like Bedford much. He is building a very fine observatory, the Astronomical Society having done him the honour of voting him the use of some valuable instruments bequeathed to them. On Thursday I breakfasted with Dr. Richardson, and gathered much useful information in geology from a *tête-à-tête* with him. On Wednesday I dined at Briscoe's: he had been in the tunnel that morning, which is now proceeding vigorously. Gurney the engineer seems determined to run a steam coach from this to Southampton—the other day it went round the Regent's Park without a horse, and ran against a gate. But he says he shall put one horse in front, who will guide it, and have no weight to pull, but merely to canter ten or twelve miles an hour. The machine is built. I have sent off a heavy box of fossils for the tower [at Kinnordy], a white hare stuffed would be a desirable addition. I miss several dogs' jaws and the cat's skull in the bones which I brought from the marl.[4] When you have time, inquire about them. Clift pronounces the bones to be the same animals I had supposed, including the wolf, but

[3] Admiral Symthe, F.R.A.S., F.G.S.

[4] From the Loch of Kinnordy.

a few are still to be made out. Of the insects in the marl, Curtis says that except two or three he cannot pronounce even on the family, they are such mere fragments. If one leg or antenna had been found, he says he would have hit off the family. Two seemed to be *Bembidium*, and another, *Helops Lim.* His curiosity, however, is much excited by some of the elytra, and if there are many fragments of the marl still in the garden, send them, for every morsel has been pulled to pieces; and as for the rock marl with *gyragonites*, it is all gone, and I could dispose of another great box. Curtis showed me with much pleasure a *noctua* sent in your spring box. It is new to him, he thinks to all. It comes nearest to *Hadena plebeia* and *Leucostegina*, but is of a more lively grey colour than *Acronicta rumicis*. As to the small *phalæna* you are quite right. It is the one which he hopes may be new; but he thinks a new *noctua* of marvellously more importance than a *phalæna*. The Miss Walkers caught on Ben Nevis and Ben Voirlich, at about 3,000 feet high, some new and many rare Lepidoptera, which they have sent Curtis. We must positively mount next year.

Your affectionate brother,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

Southampton: December 29, 1827.

My dear Sir,—I am on a visit here to an uncle, where some of my sisters are staying, and for a short season am to be in a continued round of dinners and balls, but shall at least secure a half-hour, in writing to you, from these amusements. I hope Dr. Fitton and Mr. Murchison have said something to you about filling up the map of Sussex, and certain corrections of green sand, &c., near Portsdown Hill.

I marvel less at Dr. ——'s anticipations (as I supposed them) in geological speculation, now that I observe he followed Hutton, and cites him. I think he ran unnecessarily counter to the feelings and prejudices of the age. This is not courage or manliness in the cause of Truth, nor does it promote its progress. It is an unfeeling disregard

for the weakness of human nature, for as it is our nature (for what reason Heaven knows), but as *it is* constitutional in our minds, to feel a morbid sensibility on matters of religious faith, I conceive that the same right feeling which guards us from outraging too violently the sentiments of our neighbours in the ordinary concerns of the world and its customs should direct us still more so in this. If I had been Sir A. Campbell, I would have punished those Christian soldiers who dug up the idols of the Burmese temples in the late campaign, and sent them home as trophies. To insult their idols was an act of Christian intolerance, and, until we can convert them, should be penal. If a philosopher commits a similar act of intolerance by insulting the idols of an European mob (the popular prejudices of the day), the vengeance of the more intolerant herd of the ignorant will overtake him, and he may have less reason to complain of his punishment than of its undue severity.

Believe me, most truly yours,

CHARLES LYELL.

CHAPTER VIII.

JANUARY–SEPTEMBER 1828.

ARRIVAL OF AVA FOSSILS—BOTANICAL CHAIR, LONDON UNIVERSITY—DR. FLEMING'S HISTORY OF BRITISH ANIMALS—PARTY AT SIR GEORGE PHILLIPS'S—TOUR ABROAD WITH MURCHISON—PARIS—JOURNEY TO AUVERGNE—SECONDARY AND FRESHWATER FORMATIONS OF FRANCE—VOLCANIC PHENOMENA NEAR CLERMONT—COUNT DE MONTLOSIER—BEAUTIFUL SCENERY ABOUT MONT DOR—CANTAL FOSSILS—ENTOMOLOGY—NICE—MURCHISON OVERTAXING HIS STRENGTH—PAPER ON EXCAVATION OF VALLEYS—DETERMINES TO GO TO NAPLES AND SICILY—LETTER TO HERSCHEL—PARTS FROM THE MURCHISONS AT PADUA—GIOTTO'S PAINTINGS.

[In 1828, when he had already planned and made notes for the 'Principles of Geology,' Mr. Lyell set out on a tour to Auvergne and Northern Italy with Mr. Murchison, and after parting from him in Lombardy, he continued his journey alone to Rome, Naples, and Sicily. The results of this tour appear partly in scientific memoirs jointly by his fellow-traveller and himself, and partly in the 'Principles of Geology.' Among the former, is a paper on the Excavation of Valleys, as illustrated by the volcanic rocks of Central France, read before the Geological Society in 1828, and published the year after in the Edinburgh 'New Philosophical Journal;' also a paper on the Tertiary Strata of the Cantal, published in France, in the 'Annales des Sciences,' 1829; and another on the Tertiary Freshwater Strata of Aix, in Provence, in the Edinburgh 'New Philosophical Journal,' 1829.]

CORRESPONDENCE.

To GIDEON MANTELL, ESQ.

Temple: January 17, 1828.

My dear Sir,—The best news I can send you is the safe arrival in Bedford Street[1] of the Ava fossils, of which you

[1] Where the Geological Society then was.

saw a brief account in Jamieson's last Journal from the 'Calcutta Gazette.' To say that they surpass in value any collection ever brought to Europe, from any other quarter of the globe, is to say little. In a few days the Embassy have done us a service which a man's lifetime might have been deemed well bestowed in rendering.

Crawford,[2] late Governor of Singapore, F.G.S., and author in our Transactions, was sent ambassador to the Burman King. On his return from Ava, down the Irawaddi, which they descended in a steamboat, they were detained many days in Lat. 21 N., the river having been half dried up, and the boat stranded. There was a line of hills on each side, between the river and the hills, an irregular sandy lowish region (about 300 feet above the sea). All over the surface, which was nearly bare, silicified fossils were sticking up, whose weight perhaps had resisted, when loose sand and gravel were washed away. Crawford employed his servants, and bribed the natives, to collect, and they filled twelve chests! Almost entire jaws of a new species of mastodon as big as an elephant—different from the five species described by Cuvier—smaller teeth of mastodon (Clift says may be young ones of same); silicified ivory tusk, teeth of rhinoceros, fragment of a bone of hippopotamus; jaws and skull of an enormous Gavial; jaws and teeth of an alligator; large scales, &c., of tortoises. Shells apparently freshwater —only one species—Sowerby says a Cyrene. Wood trunks of trees—monocotyledons, and perhaps dicotyledons—no botanist has seen them, structure beautifully preserved, as are all the teeth, &c.

They appear to me to have been all converted into a ferruginous chert while most of them were quite perfect, both bones and plants. Jamieson is wrong in saying they are not at all rolled. They are in some instances slightly rounded by attrition, done of course when in a soft state. Inside the hollow trunks, and adhering to the bones, is a ferruginous gravel exactly like Tilgate aggregate bed. The whole room and yard in Bedford Street looks as if it were filled with magnificent Tilgate fossils. They are of a

[2] Mr. John Crawford, author of *The Embassy to Ava.*

yellow ferruginous colour. Saurians lying in all directions—here an immense femur, there a long stem-like *Clathraria Lyelli*; here the scale of a large tortoise, there a shell and teeth of alligator, &c. &c. They will be exhibited to-morrow, and Buckland is expected to lecture on them in the evening, after the anniversary dinner.

Very truly yours,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

Temple: February 5, 1828.

My dear Sir,—I have been out of town for ten days in Hants, with some of my family who are there on a visit from Scotland. We also went to stay at Dr. and Mrs. Buckland's, at Oxford. The Canon has a glorious house, and is admirably set down for himself and geology.

I at first intended to write 'Conversations on Geology:' it is what no doubt the booksellers, and therefore the greatest number of readers, are desirous of. My reason for abandoning this form was simply this; that I found I should not do it at all, without taking more pains than such a form would do justice to. Besides, I felt that in a subject where so much is to be reformed and struck out anew, and where one obtains new ideas and theories in the progress of one's task, where you have to controvert, and to invent an argumentation—work is required, and one like the 'Conversations on Chemistry' and others would not do. It should hardly be between the teacher and scholar perhaps, but a dialogue like Berkeley's Alciphron, between equals. But finally, I thought, that when I had made up my own mind and opinions in producing another kind of book, I might then construct conversations from it. In the meantime there is a cry among the publishers for an elementary work, and I much wish you would supply it. Anything from you would be useful, for what they have now is positively bad, for such is Jamieson's Cuvier.

Buckland has been very quiet as yet as to the manifest difficulties of the Ava fossils, but will no doubt hold forth at the general meeting.

Yours most truly,

CHARLES LYELL.

To Dr. Fleming.[3]

Temple: February 6, 1828.

My dear Sir,—Lockhart is exceedingly pleased with the salmon fishery article, and tells me it had, among other merits, that which, unfortunately for him, few papers have, and which is no small charm to an editor, the requiring no sentence mending, a drudgery which he abhors, and which he says cuts up his whole time. Murray also, when I last saw him, thanked me for having been the channel of procuring your article. He has a good publisher's tact for knowing beforehand what people will read. Dr. Hooker[4] has at last made up his mind, and rejected the botanical chair[5] here in form. Young Lindley, the Horticultural Garden Secretary, told me yesterday that even he is now no longer a candidate; thinking, that as there will be no compulsory attendance for medical students, such a class will be precarious and a failure, and that the University do not guarantee such a minimum as can warrant a man, who has anything certain to give up, in venturing. I fear they have made this mistake, that they have not determined to bribe able men for the chairs that can scarcely be profitable from the classes; for Babbage viewed it in this light when offered the mathematical chair. 'What they will secure to me,' he said, 'is no more than I could make in the same number of hours by authorship, and get more fame. They have no dignity to confer as yet, they have their reputation to make. I have not. If, as they admit, they wish to get some from me, why they ought to buy it, and pay for it.' Curtis has found many new and rare insects among our last batch. I look forward to our having a grand bout of entomology and geology in the hills next summer, and bringing back a great stock of health and knowledge.

Ever most truly yours,

Charles Lyell.

[3] The Rev. Dr. Fleming, naturalist.

[4] Afterwards Sir William Hooker.

[5] At the London University.

To His Sister.

Temple: February 11, 1828.

My dear Caroline,—Curtis has positively made out the very species of two insects preserved in the marl,[6] and what is curious, though now known as northern insects, they are neither of them very common, nor I believe ever caught by us, nor are they *water* beetles. I cannot give you the names, but one is of the *Elateridæ*. That dark clay seam between the marls was by a summer's flood, as these insects prove. You really must have worked hard to name so many. On the 20th you shall have the last batch named by Curtis. I have long looked out for a *P. cratægi* in vain, but will get one for our *Artaxerxes*. I remember one season at Bartley when it swarmed, and they are so stupid, you may take them up with your hand.

Your affectionate brother,

Charles Lyell.

To Dr. Fleming.

Temple, London: April 9, 1828.

My dear Sir,—I have delayed an unreasonable time in thanking you for a copy of your 'British Animals,'[7] for which I am truly obliged to you, and the Preface of which I read immediately with much interest, and hope to make myself gradually master of the rest. I think that by putting forth your Geological Epochs you have done yourself but justice, and whatever modifications may be made hereafter on such a system as you proposed, it is one which I firmly expect will ultimately prevail in geology; and your priority in developing the idea, even so far in this country, will be referred back to with honour. I had fully intended to commence forthwith an article for the 'Quarterly Review,' but was prevented by many circumstances. One was, that I agreed to go with Mr. Murchison at the end of the present month to France, to be in Auvergne by the first week in May, to study the

[6] At Kinnordy.

[7] A 'History of British Animals,' by Dr. John Fleming.

volcanic district for some months, and connect Scrope's country with that round Marseilles, and perhaps the Vicentin. My chief defence is, that I did hardly dare review your work until I had obtained more knowledge of zoology, and of systematic arrangements, for your system has been the subject of so much criticism and cavil here, that a man need know what he is about, if he really intends to do you any good by a review.

They say that in putting mollusca before insects, you have committed the great blunder in which Lamarck had the honour of setting Cuvier right. I do not pretend to have an opinion on these subjects yet, but certainly I have more respect for a hornet than a snail, even now that they have found out in New South Wales how the former cannot *help* making true hexagons. As for omission of animals, recent and fossil, I have no doubt you are aware of the bats and other deficiencies, which will come out in second edition as *Vespertilio pygmæus*.

Believe me, very truly yours,
CHARLES LYELL.

To HIS FATHER.

London: April, 1828.

My dear Father,—I chaperoned Mrs. Somerville to Sir George Phillips's on Sunday evening, after a dinner at Dr. Somerville's. Sir G., who is one of the new Baronets, is an M.P., as is his son. A room full of Sir J. Reynolds's and other good pictures, and a famous living gallery of portraits. The party was—Sir Walter Scott, Cooper (the American novelist), Mrs. Marcet and daughter, Sir J. Mackintosh, Rogers the poet, Dumont the Genevese jurisconsult, 'Conversation' Sharp, Lady Davy, Spring Rice, M.P.,[8] Dr. Wollaston,[9] Newton the American artist, Mr. and Mrs. Lockhart, Scott's son and unmarried daughter, &c. Lady Davy, to whom Mrs. Somerville introduced me, was talking well of Manzoni's new celebrated novel, 'I promessi sposi,' so I got her afterwards upon Dante; and she said, 'I bought Rossetti,[1]

[8] Afterwards Lord Monteagle.
[9] Natural philosopher.
[1] A commentator on Dante.

and read some, but left off for fear I should feel obliged to give way to his theories. I am a devoted admirer of Dante, and should never forgive the man who lessened him in my estimation. There was too much politics perhaps before, but an allegory in every word is horrid. I admire Johnson for saying after all his labours the honest truth, that a person had best read Shakespeare after all, quite through, before he looked at a single note, and I advise all to read Dante as I have done, three times, and as I mean to do a fourth, before they read Rossetti. There is much that I cannot understand, it is true, but there is much that delights me.' Lockhart asked me to breakfast with him next morning, where Sir Walter was, who was good-humoured enough to remember me. He is much aged since last year, but pleasant company. Mrs. Lockhart says she cannot take so many bairns north of the Tweed this year, but she was much pleased with the invitation to Kinnordy, and says she had such a fancy to see Strathmore, that nothing but positive illness prevented her.

Ever yours affectionately,

CHARLES LYELL.

To MR. MURCHISON.

Temple: April 29, 1828.

My dear Murchison,—I hope you have not been expecting a letter sooner, but I was desirous of seeing my way as much as possible before I wrote.[2] Herschel called the other day with the *camera lucida*, and told me some experiments which they have had in melting granite into a slag, like lava, in glass furnaces (he and Faraday), that are *àpropos* to us; but more of that anon, as also an evening I spent with Scrope, 'Auvergnising.'

Herschel rather alarmed me by prophesying the plague I should have with my barometers, but I shall take them at all events. Dr. Hooker begs me to attend to the plants, as to the soils they live on, so I called on Bicheno,[3] who is now the authority in these matters. He says all we can do is to

[2] Projected tour with Mr. Murchison.

[3] An English botanist, secretary to the Linnæan Society.

attend to the plants which abound, as, for instance, he has done to heath in England, which is restricted in large quantities to two or three formations. When we come to a *recent* crater, or half-covered stream of lava, it will be really a very curious point to ascertain what is growing on it. If there was a large tree growing on the most recent stream, it would be almost worth having it cut down, for if it had, as some are said to have in Norway, 1,500 rings, we should carry the eruption back to Noah, allowing many centuries before any tree grew. But, joking apart, the trees and prevailing plants on the recent cones, &c., will be important. I have set up the proper boards for drying. My father writes to persuade me to take my clerk. His chief object is that he fears my eyes, which got weak some years ago under the sun of Italy, will require the assistance of my well-trained amanuensis, and that in this way some plants will really be obtained for Dr. Hooker and himself, and some insects for my sisters. If I take him, he will of course find his way per coach to Auvergne, and find his way when there on his legs principally, and I should not give him the barometers, as this disables the bearer from work, and I should possibly send him back when I quitted the mountains of France. He is clever, and I doubt not I should do more with him, but I am not quite decided if it will answer the additional expense, and am sorry I cannot talk over with you any possible objection that you might have to another servant. However, I will take care, if I bring him, that he keeps clear of incommoding the party.

Believe me, ever most truly yours,

CHARLES LYELL.

To HIS FATHER.

Hôtel Mont Blanc, Rue de la Paix, Paris: May 9, 1828.

My dear Father,—I left London May 4, slept at Dover, and on Monday evening got into the mail at Calais with Hall.[4] Next day stopped only three hours at Amiens, and arrived at Paris four o'clock on Wednesday morning. After

[4] His clerk.

four hours' sleep, breakfasted with Murchison, and had a grand day seeing people, and in the evening cut in for a famous lecture of Prévost's on Geology—cozed till midnight with him here, and next morning again with him at breakfast. He is very well, has two children, Madame in the country, at Montmorency. He is as keen as ever about Geology. Murchison has planned everything capitally, and unless my confounded passport, not sent in time from Calais, does not detain us, we start for Clermont to-morrow, geologising a little *en route*.

Murchison has ordered his letters to Clermont Ferrand. Mrs. M. very well and in good spirits. Has been dining with Lady Granville, Pozzo di Borgo, Cuvier, and other great personages, fashionable and scientific, and no end to offers of boxes to opera, &c.; but science and real work is made in spite of this the main object, and other advantages all made to turn to account in this way. They are both very industrious. I have seen Férussac, Duvan, Dufresnoy, Elie de Beaumont, and am to meet the three former again to-day.

With my love to all, believe me, your affectionate son,

CHARLES LYELL.

To HIS FATHER.

Clermont Ferrand, Auvergne: May 16, 1828.

My dear Father,—We left Paris on Sunday, May 10, Murchison and I on the box of his light open carriage, and Mrs. M. and a Swiss maid in the inside. Started at half-past six o'clock, and carriage broke down in boulevard, opposite the coachmaker's, who had made a precious job of remedying some slight damage.

Most of the road from Fontainebleau to Moulins was dreadfully out of repair, but the vehicle was got safe over, and in proportion as we approached the mountains, and receded from Paris, the roads and rate of posting improved, and at last averaged nine miles an hour, and the change of horses almost as quick as in England. The politeness also of the people has much delighted us, and they are so intelligent, that we get much geology from them.

The processions of 'Rogation,' and yesterday of the *fête*

of Ascension Day, have shown a strange contrast between the religious faith of the Auvergnois, and the provinces around, and to the north of the Loire. In the latter, there was literally none but priests singing, monks and choristers, hundreds of fine young men, and in most cases only four or five women and children following, sometimes not a single man. We heard that in some processions to distant crosses the priest had found himself at the cross alone. Here the church and procession is as numerously attended as any in Germany, yet the Jesuits have no influence, as they universally return Liberal deputies. Murchison has letters from the Deputy La Fayette's son, which ensured us attention from a useful medical *savant* on our arrival. I never did in my life so much real geology in as many days. A good paper might be written if we stopped here. We have learned many new things in regard to secondary formations in France, north of the Loire, and since that we have positively found that nothing was correctly known of the freshwater formation, either as to organic contents, inclination and disturbance of strata, mineral structure, &c. &c. So we think of writing 'On the Freshwater Formation of Central France, and its relations to the Primary, Secondary, and Volcanic Rocks,' &c. This may be considered quite a new and unexplored field, and when investigated, it must throw quite a new light on the age of the volcanic rocks, and of the elevation of the country, &c. We have generally begun work at six o'clock, and neither heat nor fatigue have stopped us an hour. Mrs. Murchison is very diligent, sketching, labelling specimens, and making out shells, in which last she is an invaluable assistant. She is so much interested in the affair, as to be always desirous of keeping out of the way when she would interfere with the work, and as far as I yet see, it would be impossible to form a better party. I sent Hall by diligence here. He had a day before our arrival, and collected insects, among which a specimen of *Papilio Antiope* is the most showy. I will see what can be done in plants, but the French say everything is well done in the botany of Auvergne, no part of Europe better. So say the *savans* of Paris; but so some say of the geology, of which we find that nothing is done. Murchison, I am happy to

find, is quite of my mind to direct all our force to where there is real work, to concentrate, and not to run, as Buckland has done, so that now he cannot literally publish on a single spot on the Continent.

Auvergne is beautiful—rich wooded plains, picturesque towns, and the outline of the volcanic chain unlike any other I ever saw. The range of Mont Dore, seen over the volcanic range from fifty miles to north of this, was covered with snow, and looked like the Alps, but they say it will soon melt.

We have been much surprised that ever since we left the chalk and oolite, and entered the freshwater formations along the Allier, we have never seen, till we came close to Clermont, *any* volcanic pebbles in the gravel, which was chiefly granitic. If most of the volcanoes were antediluvian, and Buckland's deluge caused the diluvium, how could this have happened? I verily believe that we have collected already a larger number of organic remains, from quadrupeds down to fossil seeds and shells, than have yet been published as belonging to Auvergne. Murchison is a famous hand at a bargain, and as he takes that on himself, I hope to get through very economically. He always makes a bargain before going into an inn, by which much time and expense are saved in the end. We get off within a third of what the natives pay, and for half what John Bull does *en route*; but, thanks to his campaigning of old, he loses no time in transacting this business.

Believe me, your affectionate son,

CHARLES LYELL.

To HIS FATHER.

Clermont Ferrand, Auvergne: May 26, 1828.

My dear Father,—I have just returned again to Clermont, from an expedition of five days, and we have discovered that there is no end to the work to be done in this country, and that it is of the most interesting description. The first day was spent in ascending some of the lofty volcanic Puys near here. Mrs. Murchison accompanied us, and then returned to Clermont, where she employed herself during our absence

in making panoramic sketches, receiving several of the gentry and professors, to whom we had letters, in the neighbourhood, and collecting plants and shells, &c., while Murchison and I, with my man, went on in a *patache*, a one-horse machine on springs. We first visited Pontgibaud and the Sioule, to see the excavations made by that river, in the grand lava-current of Come, which descended from the central range, and dispossessed the river of its bed. The scenery was beautiful. Just as we were leaving the place, the peasants offered to take us to a volcano farther down the river. As no Puy was mentioned in Desmarest's accurate map, nor by Scrope, we thought their account a mere fable; but their description of the cinders, &c., was so curious, that we had the courage to relinquish our day's scheme, and proceed again down the river.

You may imagine our surprise when we found, within a ride of Clermont, a set of volcanic phenomena entirely unknown to Buckland, Scrope, or the natives here. A volcanic cone, with a stream of basaltic lava issuing out on both sides, and flowing down to the gorge of the Sioule. This defile was flanked on both sides by precipitous cliffs of gneiss, and the river's passage must have been entirely choked up for a long time. A lake was formed, and the river wore a passage between the lava and the granitic schist, but the former was so excessively compact, that the schist evidently suffered most. In the progress of ages, the igneous rock, 150 feet deep, was cut through, and the river went on and ate its way, 35, 45, and in one place 85 feet into the subjacent granitic beds, leaving on one bank a perpendicular wall of basaltic lava towering over the gneiss. In the Vivarrais, where similar phenomena had been observed, Herschel had remarked a bed of pebbles between the lava and the gneiss, marking the ancient river-bed, but Buckland endeavoured to get over this difficulty by saying that these pebbles might have covered a sloping bank when the river filled the valley, and that this bank may have always been high above the river bed; for if the sloping sides of a valley, said the Professor, be covered with pebbles, as they often are, and the valley is filled with lava, and then the lava cut through and partially removed, there will of course be a line of pebbles at

the junction of the lava and the rock beneath, but these pebbles will not mark an ancient river bed. Now, unluckily for the Doctor in this case, he has no loophole. An old lead mine, said to have been worked by the Romans, happens to have exactly laid open the line of contact, and the pebble bed of the old river is seen going in under the lava, horizontally, for nearly 50 feet. This is an astonishing proof of what a river can do in some thousand or hundred thousand years by its continual wearing. No deluge could have descended the valley without carrying away the crater and ashes above. 600 or 700 feet higher is an old plateau of basalt, and if this flowed at the bottom of the then valley, the last work of the Sioule is but a unit in proportion to the other. There are several of the Clermont *savans* who, since they discovered how much we were interested with this, have given us to understand they intended to publish on it, but no doubt they will take a year before they launch out in the expense of a *patache* to Pontgibaud. Murchison certainly keeps it up with more energy than anyone I ever travelled with, for Buckland, though he worked as hard, always flew about too fast to make sure of anything. Mons. Le Coq, the botanist, a clever young man, assures me that the geology of the soils does not affect the botany of Auvergne. I shall get some specimens from him for Dr. Hooker, I expect. None to be bought, at least this year, for it seems there may be hereafter. It is a wonderful fact that *Glaux maritima* grows round some saline springs here. Busset, an engineer, who is mapping Auvergne, has forced us to dine with him to-morrow. As we know his object to be to get geology out of us, of which he knows nothing, M. fears it will be a bore, but the man is evidently clever. We shall get barometric heights from him, and a map of our little volcanic district, and if he pumps unreasonably, I shall find a difficulty in expressing myself in French. We are to meet Count Le Serres there, a gentlemanlike and well-informed naturalist, who has a property on Mont Dore, and knows more geology than any one we have met here, professors not excepted. He organised a geological society here, and they chose Count Montlosier[5]

[5] Naturalist, author of an essay on the Extinct Volcanoes of Auvergne, b. 1755, d. 1838.

as president; but the Jesuits took alarm, and, declaring that Montlosier had written a book against Genesis, got the Prefect and Mayor and Government to oppose, and at last put the thing down; at least it merged in the regular scientific Etablissement de la Ville, and Montlosier is just coming out with a book against the Jesuits, a more popular subject in France at present than geology. We are to visit him at his château near Mont Dore. We like the people and the country.

Believe me, your affectionate son,

CHARLES LYELL.

To HIS FATHER.

Bains de Mont Dore, Auvergne: June 6, 1828.

My dear Father,—I am this moment arrived here, after passing three delightful days at Count de Montlosier's, an old man of seventy-four, in full possession of faculties of no mean order, and of an imagination as lively as a poet's of twenty-five. I stayed a day longer than the Murchisons, as I was determined to have one more trial to find a junction between the granite of the Puy chain and the freshwater formations of the Limagne, and I actually found it; and my day's work alone will throw a new light on the history of this remarkable country. I believe most of the granite to have made its appearance at the surface at a later period than even the freshwater tertiary beds have, though *they* contain the remains of quadrupeds.

The scenery of Mont Dore is that of an Alpine valley, deep, with tall fir woods, high aiguilles above, half covered with snow, and cataracts and waterfalls. A watering-place with good inns at the bottom of the valley. I shall send Hall back from here, as, although he has been useful, I do not think the advantage will overbalance the additional expense. Le Coq has promised some plants for certain, and Hall has done pretty well in insects.

Believe me, your affectionate son,

CHARLES LYELL.

To His Mother.

Bains de Mont Dore, Auvergne : June 11, 1828.

My dear Mother,—We have been so actively employed, I may really say so laboriously, that I assure you I can with great difficulty find a moment to write a letter. This morning we got off, after breakfast at five o'clock, on horseback, to return from St. Amand to this : arrived at seven o'clock. But one day we rode fifty-five miles, which I shall take care shall be the last experiment of that kind, as even the old Leicestershire fox-hunter was nearly done up with it. But I have really gained strength so much, that I believe that I and my eyes were never in such condition before ; and I am sure that six hours in bed, which is all we allow, and exercise all day long for the body, and geology for the mind, with plenty of the *vin du pays*, which is good here, is the best thing that can be invented in this world for my health and happiness. Murchison must have been intended for a very strong man, if the sellers of drugs had not enlisted him into their service, so that he depends on them for his existence to a frightful extent, yet withal he can get through what would knock up most men who never need the doctor. He has only given in one day and a half yet. On one occasion we were on an expedition together, and as a stronger dose was necessary than he had with him, I was not a little alarmed at finding there was no pharmacy in the place, but at last went to a nunnery, where Mdlle. La Supérieure sold all medicines without profit—positively a young, clever, and rather good-looking lady, who hoped my friend would think better of it, as the quantity would kill six Frenchmen. M. was cured, and off the next morning, as usual. The mischief is, that he has naturally a weak though a sound stomach, and if he possessed a more than ordinary share of self-denial, and was very prudent, and after much exercise did not eat a good dinner when set before him—if, in short, he would take the advice which many find it easy to give him, he would be well.

He has much talent for original observation in geology, and is indefatigable, so that we make much way, and are thrown so much in the way of the people, high and low, by

means of our letters of introduction and our pursuits, that I am getting large materials, which I hope I shall find means of applying. Indeed, I really think I am most profitably employed on this tour, and as long as things go on as well as they do now, I should be very sorry to leave off; particularly as, from our plan of operation, which is that of comparison of the structure of different parts of the country, we work on with a continually increasing power, and in the last week have with the same exertion done at least twice as much in the way of discovery, and in enlarging our knowledge of what others had done, as in any preceding. I expect it will be at least three weeks before we can have done with Central France, and then we hope to work south towards Nice, down the Rhone, keeping always in analogous formations, and then to the Vicentin if possible, though this is very uncertain, as we can never see far before us, either as to time or place, directing our course according to the new lights we are gaining.

We shall leave this place in a day or two. I like it well enough, but it is certainly too early in the season to enjoy it, and Mrs. Murchison suffers from the cold and damp, though she has not often complained in this tone.

Mont Dore is partially covered with snow, and almost always with clouds, and the transition in coming up here from the low country is violent. Yesterday we rode up from the climate of Italy to that of Scotland. It is the most varied and picturesque country imaginable. There are innumerable old ruins for sketches, with lakes, cascades, and different kinds of wood, so that we wonder more and more that the English have not found it out. The peasantry are very obliging, industrious, well-fed, and clothed, and to all appearance are the happiest I ever saw. We have crossed the chain of Puys, the Limagne, and the valleys leading from Mont Dore, in all directions. The people in the higher regions begin to talk French—at least, there are generally some who have served in the armies, and their children catch some from them. Their own language has a good deal of the old Provençal in it, and a great many of the terminations are Italian. In short, we often find a demand in Italian succeed when French misses fire; but all our am-

munition often fails to produce any impression. The population is dense, and bears no resemblance to other parts of France that ever I saw. In the mountains a large portion do not believe that Napoleon is dead, especially the old soldiers. There is an almost entire want of gentry here, but as it does not arise from absenteeism, but from the great subdivision of property, it evidently produces no ill effects on the character and well-being of the people.

Give my love to all at Kinnordy, and believe me,

Your affectionate son,

CHARLES LYELL.

To HIS SISTER.

Puy en Velay: July 3, 1828.

My dear Caroline,—I was glad to find your letter awaiting me here yesterday, though now of a somewhat ancient date, and hope that another will arrive before we quit this, in about a week, from some one. We have now seen the Cantal district, of which Aurillac is the principal town, and I was there particularly interested with the freshwater or rather lacustrine deposits; as although of an older date than all the volcanoes of that country, and constituting chains of hills, their correspondence, when considered foot by foot with the beds which are at our door in the marl loch, is as complete as you can imagine. The same genera of shells and compressed vegetables, and seeds of chara, &c., of which we hope to add many new species to the fossils hitherto known. I hope, by the way, you will not forget, when the marl is dug, to keep up inquiries for jaws and teeth of animals, and if you can get some good specimens of the shells, it will help me; for now that I see the perfect analogy of these older formations, I am resolved to give a notice on the minor details of our loch. I am in great expectation that some of my Cantal fossils will prove the elytra of beetles. They were in marl near Murat in Cantal, upon which rested an enormous load of different volcanic materials, such as currents of columnar basalts and other lavas and breccia, no less than 800 feet in a very precipitous height. Yet the limnei and planorbis and other lake remains in the foundation beds were not injured,

and looked just as marls might do in Angus. The most characteristic people we have seen are perhaps those of Mont Dore, but they are an oddish race throughout these regions of Central France. The language varies as we move about, and is always equally unintelligible; it is more Spanish here than farther north. The communication between the capital and the interior is wonderfully small, but to our surprise the roads have been far better than near Paris, and the carriage has never been broken since we crossed the Loire. They macadamise their roads in good style. This is a most extraordinary and picturesque valley, whereas the Cantal, though interesting to a geologist, has not much to boast in that way. Mont Dore is fine and Alpine, but then it is not equal to the Swiss Alps and in the same style. But the chain of Puys of Clermont is so perfectly unlike any other European chain, and its Prince, the Puy de Dôme, is so handsome, that this is worth a visit by all who travel in France.

We flatter ourselves we have got more ample materials for the geology of these parts of France, at least on the modern rocks, than have as yet been published on any districts of equal extent and equal distance from Paris; and as this has all been done in seven weeks, we should have something to show at the end of six or eight weeks more, if all could go on at the same pace. But I do not think the Murchisons will stand fire. Symptoms of flinching from the heat, which makes scarcely any impression on me, begin to betray themselves. Thoughts of a retreat to the Alps, consultations with me whether I think it practicable to proceed farther south in the dog-days, have been mooted, and I suppose the whole scheme will hardly be persevered in just as if Sedgwick and I were here together, determined to hunt down thoroughly one subject at a time. But as far as we have gone, I was never with a better man for doing work well than Murchison, and as we have two weeks before us here, that will be a good deal to have secured. The French, since I was last on this side the water, have come round marvellously to our costume, and they are on the high road to become just as great politicians, and in many respects to be more like us. If our people would have the same good sense to take from them what they surpass us in, it would be a good

compromise. Their system of early rising, and spending a moderate time at dinner, agrees famously with those who wish to make use of their evenings and still see society. If Prévost had known these parts of his own country, he would not have regarded the scene at Penzance on Guy Fawkes's day as particularly John Bullish. For on St. Peter's day we saw at St. Germain in Auvergne, and other towns, bonfires and fireworks, and the peasants pushing each other into the fire and jumping through it. We are to visit the country house here of Bertrand Roux, author of a geological work on these parts. He is a merchant, and an intelligent man.

I sent back Hall from Mont Dore. The last two days were the first in which he signalised himself by doing anything whatever in entomology, for he then took about two dozen of *Blandina*. We saw numbers afterwards.

With love to all, believe me, your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Aubenas, Ardêche: July 15, 1828.

My dear Marianne,—We found Puy en Velay a very extraordinary and beautiful town, with some remarkable rocks standing up in it like Edinburgh Castle, and as well covered. Our introduction to M. Bertrand helped us not only to the best geological cicerone we have yet met with in France, but also an agreeable opportunity of seeing two large French establishments, his own and his mother-in-law's, Madame de Laintenot, who, in being able annually to visit Paris, is a great personage among the provincials. We spent a day at her place, and two at Bertrand's, who inhabits a fine old monastery called Doue, which his father, a rich merchant, purchased in 1791 out of the Revolutionary plunder. He is himself a merchant. The ladies, young and old, displayed a curiosity about Mrs. Murchison's dress and English wardrobe that would have diverted you. Considering the natural gaiety of the various persons we met there, we were somewhat amused at one favourite theme of regret, expressed by many of the old people, that the French were becoming too *serious*. They attribute this to the English

style of education, which they say is now being introduced, which, although right in many respects, is carried to an extreme. *C'est plus solide*, they say, than theirs was, and there was once some reason to accuse them of *légèreté*, but there is a medium. Even our friend Bertrand seems decidedly to take the same view of the matter, though he accounts for it in another way, for he says every young man now looks early to a profession. None go out of good society, as formerly, into the Church and monasteries, and there being no elder sons, none can afford to be gay and thoughtless. But even he appears to see too much puritanical severity in the rising generation, which I have certainly not seen, and as far as a traveller can judge, they are still an infinitely more lively people, high and low, than we are, and look at least happier, especially the peasantry of Central France. From Le Puy, where we stayed eight days, we went to the Haut Vivarrais. The descent from the granite mountain of Velay to Vivarrais (now Ardêche) is exceedingly fine, the outline of the hills very Alpine, and the deep valley clothed with rich chestnut trees, and vines dressed in the Italian style. We stayed three days at Thueyts, a small town in the Ardêche, whence we were able to examine carefully what Scrope in a letter calls 'the pet volcanoes of the Vivarrais;' and such they really are, very far surpassing all the two or three hundred we had seen in Auvergne, Cantal, and Puy. All lovers of the picturesque, and who have got no farther than 'a taste for geology,' should come to these, for they will find it all so clear, as well as beautiful. The craters are so perfect, yet the cones covered with such fine zones half-way down of chestnuts, and the lava currents eaten into by the rivers, present such splendid colonnades of basaltic pillars, that it is a country to make everyone desire to know something; and as the granitic schists in which the valleys lie are all of one kind, there is no danger of the volcanic matter being confounded by anyone with the older rock through which it has burst, or over which it has flowed. The proofs of their immense antiquity are quite enough to bear out Scrope. But Murchison and I must take care how we recommend any English to come here, as there is no post over much of the road, and the *voituriers* have no harness, and cannot

drive two horses abreast, and scarcely in a single instance in Central France can they be trusted. For ten miles there is a broad road worthy of the magnificence of the *Grande Nation*—bridges quite splendid, rock blown through, &c. Then all at once stones and ruts and a narrow lane, with a frightful precipice at the side, and no parapet. As far as steady geological work goes, I have not had a single day to regret since I entered Auvergne, two calendar months yesterday. Amidst solemn declarations on the part of Murchison that he cannot go south in the dog-days, he has ordered letters to be addressed to Nice, where I hope to hear from you. You will not suppose that any attention has been paid to entomology, except what has been unavoidably done in the *Aptera* and *Diptera*, the former of which have been sacrificed in large numbers by the Murchisons, having robbed them of many a night's rest. They have spared me, but in the day-time the *Diptera* have attacked all indiscriminately, both man and beast, ever since we passed the first Spanish chestnuts, on our descent from the high central plâteau towards the Rhone. This country breeds many silkworms. They tell me that two caterpillars, and frequently three, spin the same cocoon, which then contains three pupæ. The greater part of the *Lepidoptera* are English acquaintances, and were remarkably so till we descended from Central France, as were the plants.

Believe me, your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Marseilles: August 3, 1828.

My dear Caroline,—At Aix there has been discovered, within a year, a thin band of fissile, compact, calcareous marl full of insects. It divides into thin laminæ, as does our Kinnordy insect bed, but is a solid stone. The insects, even the gnats, are beautifully perfect, wings, antennæ, and all. Until we came all had gone to M. de Serres of Montpellier. He has made out fifty genera. The beetles are chiefly *Curculionidæ*; most of the rest are *Diptera*, *Musca*, and *Culex*, &c. A perfect *Gryllus* and a *Forficula* are amongst them.

There are so many, that I am in hopes they will somewhat aid the question as to the climate of these parts when the tertiary strata were formed. The series of strata in which they occur is 400 feet thick, and the fish and shells show them to be freshwater, probably found in a lake. The country has been much thrown about since, and the insects must be of great antiquity, though not old, geologically speaking, for hills and valleys have since been formed. Murchison kept saying, when we were hunting about the quarries and getting them from the man, 'How I wish your sisters were here, they would enjoy the chase, and then we might be at work at the geology.' I think we have got at least fifteen genera, and more will be sent us. We find provincial geologists almost everywhere who know enough to be useful. Nismes is a glorious remnant of Roman grandeur, with an amphitheatre and temple nearly entire. The old aqueduct at the Pont du Gard, north of Nismes, is as fine as almost anything in Italy. There is a triumphal arch and tower, like the lantern of Demosthenes at St. Remy, between Nismes and Aix, of great beauty, and of which, if at Rome, antiquaries would talk through folios. Montpellier is the most luxurious place we have seen, and this the cleanest seaport. The troops are passing in daily, returning from Spain, much quizzed by their countrymen and women, for being burnt as black as Spaniards. The generality here are fair, spite of the sun. Other troops are going out to the Morea, such a stunted race! By accurate calculation of the height of men of the levy since the peace, it is found that the mean height of Frenchmen has been diminished several inches by the Revolution and Napoleon's wars. These are now the sons of those who were not thought by Napoleon strong and tall enough to fight and look well. But they will rout the Egyptians for all that, and I suppose be a match for the Russians.

With love to all, your affectionate brother,

CHARLES LYELL.

To His Sister.

Nice: August 20, 1828.

My dear Eleanor,—There has not literally been one drop of rain here for eight months! So all the rivers are quite dry, and the stagnant waters are not a little odoriferous, and were it not for some protecting saint, the malaria would have its head-quarters here, according to the modern doctrines on that subject: and why it never visits Nice, is certainly a puzzling problem. The only French journals admitted here are the ultras, who are defending the cause of the persecuted Jesuits, and are just now very angry with the liberal papers for some profane quizzing of the Archbishop of Paris, who has been praying for rain. While he is about the matter, he may as well have it sent here, for they hardly hope for a drop for a month to come, and do not think it at all unprecedented. Murchison has not regained his strength from a severe attack at Fréjus, so as to be able to take the field again. But we have been hard at work in writing, from our materials, a paper on the excavation of valleys, which is at last finished, and after two evenings' infliction, is intended to reform the Geological Society, and afterwards the world, on this hitherto-not-in-the-least-degree-understood subject. Besides this mighty operation, we have performed two jaunts with Mrs. Murchison, each at half-past four o'clock in the morning, to see certain deposits of fossil shells, and collecting these, with which she has been much pleased; and this and the cessation of eternal bustle, while the campaign was at its height, while we were as yet only crossing the Balkan, and before our descent upon these hot latitudes, has restored her health and spirits, which had failed sadly. Her lord has a little too much of what Mathews used to ridicule in his slang as 'the keep-moving, go-it-if-it-kills-you' system, and I had to fight sometimes for the sake of geology, as his wife had for her strength, to make him proceed with somewhat less precipitation. You may suppose it was not over prudent to attempt hard work, and only to sleep, or rather to be in bed, five hours at most. I expected a break-down before. I trust still to start in a

few days to the Vicentin, either by Genoa or the Col de Tenda, for that country must afford some curious analogies and lights to what we have seen in Auvergne. The people are polite and agreeable here, the Government unpopular, though most absolute. Numbers of soldiers and priests everywhere. The principal librarian has no books but what he sells to 500 English who reside here in winter. He says the inhabitants of the great city never read scarcely even novels. What, then, do they do? 'Can you not see? They sit in cafés, play billiards, hear the bands play, go to mass, and give and attend fêtes.' All this makes the place very gay. Everything is quite gone back to the old *régime* in good earnest. And when the Jesuits are exiled from France, if they dare execute that order, they will find the receptacle prepared by the King for them here, a congenial home. They are positively hiring apartments now for French pensioners, youths who are to follow them into exile for education. Our kind old host Montlosier's works are so attacked by the ultra journals here, that it is clear they produced no small effect. I caught a curious *Mantis* this morning, the peasants call it 'prega-dio,' and when it erects its neck, and holds up its chelæ and clasps them, it certainly seems to be saying its prayers. I shall try and catch some gnats for him in my room, for, in spite of a mosquito net, they have bitten me all over. One day of winter in Italy would do more for geology than a week of this everlasting blue sky: even the Italians are sick of seeing it. No wonder we are so much in the dark in geology as to India and the tropics! If I ever attempt to understand the south of Italy as well as I hope I now do Central France, it shall be in winter, or before May. All our best men made the blunder we have. We went out in the bay on Sunday with a famous diver, who brought up sponges and other creatures that I had never seen alive before. He took down a hammer, and, when out of sight, knocked off the stone-perforating shells.

With love to all, believe me, your affectionate brother,

CHARLES LYELL.

To His Father.

Nice: August 24, 1828.

My dear Father,—Before we cross the Alps, and enter as it were upon a new expedition, I will send a few words on the fruits and adventures of our past tour, and the plans I wish still to realise before I return. The paper which we have written here, and which for the first moment almost has had time given it to think over any of our data, has encouraged us to be sanguine as to what has been obtained. The whole tour has been rich, as I had anticipated (and in a manner which Murchison had not), in those analogies between existing Nature and the effects of causes in remote eras which it will be the great object of my work to point out. I scarcely despair now, so much do these evidences of modern action increase upon us as we go south (towards the more recent volcanic seat of action), of *proving* the positive identity of the causes now operating with those of former times.

At this very place, which Brongniart and Buckland have been at, without seeing, or choosing to see, so unwelcome a fact, we have discovered a formation which would furnish an answer to the very difficulty which Sedgwick when at Kinnordy put to me. He said, 'You who wish to make out that all is now going on as formerly, help me to conceive a sea deep enough and disturbed enough to receive, in any length of time, such a series of strata of conglomerate and sandstone as you have shown me in Angus.' Now here we have just such a series as that in Forfarshire, only very much thicker, and in the intervening laminated sands are numerous perfect shells, more than 200 species in Risso's cabinet, eighteen in a hundred of which are *living Mediterranean* species, whose habits are known. By this grouping of these shells and their state, the sea is proved to have been in a perfect state of tranquillity, except at those periods when the pebbles were washed down. This conglomerate is intersected by a valley and a gorge, displaying it for fifteen miles! The hills of conglomerate are some 800 feet high, and at this height are fossil species, which may be the

identical ancestors of others that now live opposite here, where the sea within gun-shot of the shore is 3,000 feet deep, measured by Saussure, and since verified. Into this the Magnacon, after not flowing a drop for eight months, brings yearly multitudes of pebbles. But I feel, as Murchison says, that if I wish to get out, by November year, such a book as will decidedly do me credit, and probably be a source of profit, it is to the south of the Po I should hasten, and before Christmas everything might be done. He said yesterday, 'At Milan or Verona, in three or four weeks or thereabouts, the operations connected with our paper will be over, but Sicily is for your views the great end: there are the most modern analogies, volcanic, marine, elevatory, subsiding, &c. I know the island as a soldier, and if you make straight for Etna, will just time it right for work, for the season will be exactly suitable.' . . . I feel so decidedly that three months' more steady work will carry me through all, and tell greatly both to the despatch of finishing my work, as well as to the power I shall have in writing it, that I should greatly repent if I did not do all in my power to accomplish it now.

With my love to all, believe me, your affectionate son,

CHARLES LYELL.

To SIR JOHN HERSCHEL.

Milan: September 9, 1828.

Dear Herschel,—I arrived here with the Murchisons yesterday, and to-morrow we start for the Vicentin, where we hope to finish successfully the remainder of the plan which was talked over with you, and which has been thus far executed much to our satisfaction. We profited much by your hints and memoranda, and Murchison begs me to say that he intends still further to benefit by your advice in the Val de Fassa, though his time will be shorter than he had intended. We part at Verona, and I then hope to make out a tour in S. Italy and Sicily. I now regret much that I had not formed this scheme before I left England, for although I believe I remember pretty accurately the principal geological facts in regard to Sicily which you and others gave me, yet for want of noting the localities I shall be little able

to avail myself of them. You would render me a great service if you would send me, in a letter to Florence, any hints and advice on points of geology which you think should be investigated, and which you either saw, or think you omitted. As we have not been idle as far as our time permitted in Auvergne, Velay, and Vivarrais, in working at the relations of the volcanic to the tertiary and other associated rocks, I am prepared with a moderate stock of queries, and of difficulties, to be answered I hope by studying a more modern volcanic district. The effects of earthquakes on the regular strata, and the light thrown on the excavation of valleys by lavas, are subjects to which I have directed a large share of attention. I should therefore be anxious to examine such parts of the coast of Sicily or Calabria as afforded evidence of elevation or subsidence, either by the aid of buildings, &c., raised or sunk, as at Baiæ, Temple of Serapis (if the latter be not otherwise explicable), or by help of modern species of shells lifted up, or sea beaches. Wherever you observed signs of such effects of earthquakes in Sicily, I should be glad to have the localities, and where you saw the greatest fissures, if any, still open. The disturbance in the freshwater strata of Auvergne and Cantal, due to volcanic action, is so much greater than I had been led to expect, and that of the sub-Apennine beds from Montpellier to Savona, containing as they do nearly twenty per cent. of decided living species of shells, that I cannot but think that Calabria and Sicily must afford proofs of strata containing still more modern organic remains, raised above the level of the sea. If you will inform me how you moved about in Sicily, I shall be much obliged to you, and any desirable head-quarters, from which much may be learnt, besides Catania and Palermo and Messina.

As I know how well and how fully your time is occupied, I am aware that this request is somewhat unconscionable, but however few the memoranda you can favour me with, I shall prize them much. The names of any localities, or persons or things to be seen, or to be avoided, in a tour of a few months, is what I am most in need of, or any books which I should buy or read. We asked here for the Council of Mines. 'It is done away with.' For Brocchi's successor,

'The chair exists no longer.' For his collection. 'It has been pillaged by the Germans, and they have left nothing worth seeing.' Is there no scientific establishment left? 'There is only the library.' So much for the paternal government of Austria.—Believe me, ever most truly yours,

CHARLES LYELL.

To HIS FATHER.

Padua: September 26, 1828.

My dear Father,—The Murchisons left this for the Tyrol this morning, and I start for Verona this evening. I came here that I might examine the Euganean Hills, the geology of which is interesting.

The new road by the Maritime Alps is quite a fine addition to the English tourists who wish to vary their way over the Alps. The scenery is remarkably identical in character with that which we saw along by the Gulf of Spezzia, supposing greater height of the mountains; and it is throughout the same. The road is always in sight of the sea, often overhanging it on a precipitous steep of some thousand feet. Hills covered with old olive trees, and now and then large orchards of lemon trees. These here and there exchanged for vines. The palms in many gardens of considerable height, and great prickly pears hanging over walls. Sea, deep up to the rocks, which rise boldly out of it: scarcely ever a sail.

Between Savona and Modena we did an agreeable piece of geology, the Cadibona coal basin, evidently a lacustrine deposit. As it was unoccupied ground, and of interest from producing a curious fossil quadruped, called by Cuvier 'Anthracotherium,' we expect it will make a good subject of a notice for Jamieson's Journal as soon as I return. The neighbourhood of Turin may perhaps lead us to another notice, for our passage over the Apennines from Savona to Alexandria certainly gave us a key to the environs of Turin, on which such blunders are current, that we may be excused if we set some right, even though we cannot pretend to have done the district. But this will not be for the Geological Society, to which we give the paper I mentioned, and one on

the freshwater formations of Auvergne, if our specimens all reach London in safety.

From Borelli, the conchologist at Turin, and others at Vicenza and this place, we learnt much. But the chief advantage from a few days' hard work at Monte Bolca and other parts of the Vicentin will be, that it renders us quite competent to judge the merits of and to understand the various works both of the ancients and moderns on this country. The volcanic phenomena are just Auvergne over again, and we read them off, as things written in a familiar language, though they would have been Hebrew to us both six months before. The trachyte of the Euganean Hills is the porphyry of Lintrathen and the Clune,[6] so is that of Mont Dore—all identical—and the felspathic lavas of the volcanoes of S. America come quite close to them. It is here pinkish, as in Forfarshire, and sometimes regular as there: so it is in the lava streams from Mont Dore.

I asked Giapelli, an eminent engineer to whom Count Marzari Pencati of Vicenza gave us letters, to take me to see Giotto's pictures, on which Phillips gave a good lecture in Somerset House last spring. I suppose we saw them in 1818, and that you remember them. To me they were quite new. The Chiesetta dei Cavalieri Godenti has all the walls painted by Giotto. It is in the amphitheatre (Roman), or rather joins and looks into it. These knights were a powerful and religious order, contemporary with the Templars. They called themselves 'Rejoicers in the mysterious joy of the blessed Virgin.' Fresco I believe was then unknown, and the plaster was coloured in a manner which you know, yet the colours remain. On one side over the door is a view of Hell. The devil is a faithful portrait, full length, of the Burmese idol lately set up in the British Museum. (As there are many Eastern figures in other parts, Giotto may through Venice have got some imagery from Eastern superstition.) He is eating a naked figure, and griping another in his claws. On his right is a Pope, with the white tiara, holding a purse full of money with a fast grasp in one hand, and stretching out the other to *bless* a starving woman, who is begging of him. Not far off is a naked cardinal, with a

[6] Forfarshire rocks.

red cap. Two demons near the entrance gate are pulling in head-foremost a priest in his black gown. On the devil's left hand are numerous demons pushing various figures into a gulf of mud. Giapelli tells me that Dante and Giotto were friends, and that it is not known whether the painter borrowed from the poet, or the poet from him. But that a religious order of knights should have had this satire blazoned on their walls, is a trait of the times worth knowing! Of course the vulgar were not admitted. The form of the room is that of many meeting halls of Freemasons. When it became a church, they could not destroy it, without its making the satire more public, as a chancery injunction, or K. B. prosecution for blasphemy, circulates the evil tenfold. But it is singular that they chose to make it a church, and shows that it must have been received doctrine that the wicked among the popes and cardinals might expect equal justice. All this is of course in print somewhere. I am going to Parma with a letter from Buckland to Professor Guidotti, from whom he says he learnt most of any north of Apennines, in Italy. I hope I may hear from Kinnordy at Florence. All tell me that if I would do Etna well, I must lose no time, because of snow.

With my love to all, believe me, your affectionate son,

CHARLES LYELL.

CHAPTER IX.

OCTOBER 1828—JANUARY 1829.

PARMA—PROFESSOR GUIDOTTI—FINE COLLECTION OF FOSSIL SHELLS—ADVENTURE AT THE DOUANE AT PARMA—GEOLOGY OF THE VALLEY OF THE ELSA RIVER NEAR SIENA—ANCIENT VOLCANOES NEAR VITERBO—GEOLOGY OF ROME—NAPLES—EMBARKS FOR ISCHIA—PÆSTUM—TEMPLE OF NEPTUNE—CATANIA—ASCENT OF ETNA—THE CASA INGLESE—THE GEMELLAROS — HARDSHIPS AND ADVENTURES — SYRACUSE — AGRIGENTUM — A FESTA — PALERMO—BANDITTI—DIFFICULTY OF LEAVING SICILY—RETURN TO NAPLES.

CORRESPONDENCE.

To His Sister.

Florence : October 10, 1828.

My dear Caroline,—I went from Padua to Verona, and made a good geological expedition to the celebrated Ponte di Veja, a natural bridge over a valley, which is a very striking object. As I found no letters at Verona, I went to Parma with a letter to Professor Guidotti, a gentlemanlike and agreeable man, who welcomed me in a most delightful manner. He has the finest collection of fossil shells in Italy, and as they chiefly belong to the most modern formation, it was of first-rate interest to me to get from him a multitude of facts. You may suppose I was not a little happy to find that he was anxious to have as much geological instruction from me which my tour had enabled me to give him. So we spent three days, from six o'clock in the morning till night, exchanging our respective commodities, and I believe those which he gave me were at all events the most substantial, for he liberally presented me with a set of most of those shells which occur in the sub-Apennines, *identical* with species now living in the Mediterranean, to me a useful

gift. He was so excited by our geological researches and conclusions, that the very day I left Parma he started on an expedition planned by me. Imagine what fossil conchology has become in this country, when I tell you that he has 1,100 extinct species as perfect as when they lived, which is infinitely beyond the number now living in the Mediterranean and Adriatic, and he finds at the rate of 50 new species a year, which fishing in those seas would not do. At Bologna I introduced myself to Professor Ranzani, who showed me the Museum, &c., and gave me a recommendation to Professor Targioni here. In the two days which it required for a vetturino to crawl over the Apennines, starting at 5.30 and arriving after dark, I made out the series and succession of rocks very well, for I always walked when the horses did, being unable to sit upright in the cabriolet. But after all, one gains in information, as well as in pocket, by travelling thus: you hear Italian talked, a great point, and see many curious characters. Our party consisted of a clever and pleasant French lawyer, a young Greek gentleman educated in Italy, a Sardinian priest, and a French merchant, all men of my own age. Targioni introduced me here to Professor Nesti and Baron Bardi, who showed me the Museum. With their instruction, I rode to the upper Val d'Arno, a famous day for me—an old lacustrine deposit corresponding delightfully with our Angus lakes in all but age and *species* of animals; same genera of shells. They have just extracted the fortieth skeleton of hippopotamus! have got above twenty elephants, one or two mastodons, a rhinoceros and stags, and oxen out of number. I forgot an adventure at the Douane at Parma. Dr. Lorenzone of Vicenza had given me some Monte Bolca fish as a present. I told the officer they were not minerals, and after a debate he said, as there was no metal in them, perhaps they were not, but I must declare what they were. 'Pesci petrificate.' 'Dunque sono cose vegetanti,' and showing me that the law enumerated all vegetating things, he insisted on taxing me. As I knew the joke would be relished at Parma, I told him to make out a bill, for I meant to appeal. But when it was drawn up, the soldiers and clerks laughed and quizzed the Douanier, so that he threw the bill into the ditch, and made

out another, calling them *minerals*, to my great disappointment. He only made me pay threepence English! I am rather stiff to-day, for I had to ride to Val d'Arno and back, 37 miles, and walk ten to fourteen hours,—hard work. I got a letter from Murchison here; he has worked hard in Tyrol. I got a famous letter also from Scrope, full of geological and practical hints on Sicily. I must make up my mind to rough it in earnest, it seems. He recommends boating a good deal off the coast, because the sailors are more honest than the landsmen there, and because my boat, drawn up on the sand, will be a far better bed than any I can get there. How comfortable! He also declared that as they gave him dogs to eat, and stones, miscalled bread, that portable soup would be as indispensable as to Captain Parry. He speaks of course not of the Grande Route, but of a geologist's. I feel more and more every day, that unless I see some district with my own eyes which has suffered from recent earthquakes and recent volcanoes, the first start of anything I write would be at a halting pace, and built on the facts of others, which might perhaps, as applied by me, afterwards give way, and down would come the theory, true or false.

To-morrow I start for Siena. I shall be very glad to hear from Kinnordy at Naples.

Your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Rome: October 20, 1828.

My dear Marianne,—I believe I gave Caroline a history of my progress to Florence, in the two days' journey from thence to Siena. I contrived, by dint of a small gig and boy, to do a great deal of geology, going round by Colle and the valley of the Elsa River, which was a favourable tour for me, as bringing down the chain of geological events to a later period than any of equal extent which I had seen, except, perhaps, in the Upper Val d'Arno. But the lacustrine formation of Elsa was new to me, not only as containing in it

much travertin, just like the Bakie limestone,[1] but because there are hot springs still producing the same rock. I believe the shells (freshwater) of Elsa will prove all recent ones; the *Neritina* have their colour well preserved. Yet there are valleys 100 feet deep, and towns in them in this series of strata, which overlie others, analogous to our most modern in England, excepting of course our Angus Lake deposits. That part of Tuscany is very picturesque. At Siena I had not the same good fortune I had had at Florence to find the geologists in town. One to whom I had a letter, Mazza, was just getting on his horse for an absence of several days, but stopped an hour, and showed me a collection of fossil shells, which, if I had not seen Guidotti's at Parma, I should have thought much of. After one day's exploration of the geology of Siena, I took a gig for four days to Viterbo, in no small fear that I should repent having defied the rain; but as Murchison and I were never stopped once in three months by rain, so I had three splendid days for my work, and, indeed, half the fourth, when I got inside a *voiturier's* machine for the rest of the way to Rome, and then it rained plentifully. Almost the whole way from Siena to Viterbo is a theatre of extinct volcanic action. Such repeated layers of ashes, pumice, tufa, and dust, cemented with stones in very thin seams, that the eruptions must have been numerous beyond measure, as high hills are formed entirely in this manner. These and the lavas were just like Auvergne, but there are more fine lakes in ancient craters than one can see in France. Bolsena is the largest. All these spent volcanoes threw their ashes and lavas over that formation which contains the 1,100 species of marine shells which I mentioned I had seen in Guidotti's collection. Some geologists pretend that there are proofs that the volcanoes began before these strata had done forming, which may be true of some; but I have seen none yet, although I have been from morning till eve immersed in matters relating to times beyond the flood. I must of course have had many adventures of post-diluvian date, and among those I may enumerate the vile Douane, where all my shells and specimens were opened and disturbed. In the coach at Viterbo I found a Roman priest,

[1] In Forfarshire.

head of a college, who had been thrown by accident with two Scotch clerical students (going to the Irish Catholic College for their education), who could not talk Italian or French, and were getting on in moderate Latin with the old gentleman, in which language for a whole day, for the first time in my life, I had to talk all the way to Rome. At Rome I found the geology of the city itself exceedingly interesting. The celebrated seven hills of which you have read, and which in fact are nine, are caused by the Tiber and some tributaries, which have cut open valleys almost entirely through volcanic ejected matter, covered by travertin containing lacustrine shells. The volcanic strata repose in the Monte Mario on the sub-Apennine formation, or strata containing shells analogous to our *most recent* formation in England. The shells in the travertin are all real species living in Italy, so you perceive that the volcanoes had thrown out their ashes and pumice, &c., and these had become covered with lakes, and then the valleys had been hollowed out all before Rome was built 2,500 years and more ago. Thus giving us a grand succession of events later than the formation of the Monte Mario beds, in which *few living* species of shells are found.

Naples, October 29, 1828.—After two rather fagging days, I arrived here safe. I persuaded the whole party (four Frenchmen who were with me posting to Naples) to stop and see Lake Albano, the crater of an old volcano, with which they were fortunately delighted, as very picturesque. The Pontine Marshes are nothing but the swampy deltas of three rivers, like the lower part of the plains of the Po. Arrived here, I went straight to Colonel Visconti, the geographer, Capt. Smythe's friend, who immediately put me in the way of everything. As all the geologists were gone to the island of Ischia, where I always intended to go, I embarked immediately, and just arrived in time to *miss* them; fortunately perhaps, for in three days' active examination of that beautiful isle, I flatter myself I made some discoveries, which if I had been lionised I should certainly have missed. I found shells, among other things (marine), 2,000 feet high on the old volcano, which had not been dreamt of here. But the people!—nothing you ever heard of

them is I believe exaggerated. I do not mean as to the graver charges, for of course those only who live much among them can judge of that, but as to what one sees characteristic in passing through them. It seems as if one half of an immense population, noisy and cheerful, had nothing to do, and the habits of course of those to whom time is of no value are most inconvenient to anyone who wishes to make good use of his. On an expedition, the hours spent in bargaining is a nuisance to which even the north of Italy is a joke. In the shops there are no fixed prices. Whatever contract you make, your driver or boatman finds he has done something more than was specified, into which he has designedly led you. The Ischians are just the same, and famous gasconades. The following was my *rencontre* yesterday with a chasseur, on the hills, about my age. 'Where does this aqueduct go to?' 'To Ischia, sir; five miles long, and cost 25,000 piastres.' 'How old?' 'Eighty years; built by the town.' 'Was it injured by the earthquake of February?' 'Not a stone; had it been thrown down, Ischia would be dead; they must drink salt water.' 'Were any houses in Ischia hurt?' 'Not one, by St. Nicholas! I wonder at it.' 'So do I, it was very close to Casamia.' 'No, no, no; I don't mean that; but in Casamia they are honest folk, but in Ischia all rascals, robbers, assassins, 5,000 of them, and all thieves, by St. Nicholas, I wonder they were spared.' The Government have sent off the steamer to Marseilles, and I must work here for a week. No other way of going, for the pirates of Tripoli have taken so many Neapolitan vessels, that no one who has not a fancy to see Africa, will venture. The rain has begun to-day.

Your affectionate brother,

CHARLES LYELL.

To RODERICK MURCHISON, ESQ.

Naples: November 6, 1828.

My dear Murchison,—I am just returned from a safe expedition to Pæstum, and as far as shells in the travertin are concerned, I hope to do a little, but in general the geology between this and the plain south of Salerno is very flat,

the Apeninnes, as usual, presenting that dearth of fossils which renders them everywhere so monotonous. They are very siliceous in these parts, cut into deep valleys, and near Vietri is a fine example of an old lacustrine formation, which was gradually deposited when the valleys between that and Salerno were two or three hundred feet less deep than now. It was in the style of Cadibona, and though I found nothing but small pieces of carbonised wood in some of the red clays (red just like the cement of Mediterranean breccia), I have no doubt that remains which might rival the *Anthracotherium* would reward a good search, of which in this country there is no chance.

As I passed rapidly from Rome to Naples, I shall reserve my observations in that country till my homeward journey enables me to fill up certain hiatuses. Here I found the steamboat, by which I was to have sailed forthwith to Palermo, detained by the Government on special service, and as I was condemned to the Phlegrean Fields for twelve days, I sailed immediately to Ischia, after passing the Solfatara, Monte Nuovo, Lake Averno, &c., on my way to Puzzuoli, and seeing them all. I found Ischia just what I had hoped, a most admirable illustration of Mont Dore, with the difference which we sometimes wished for, as the substitution of marine for freshwater, and the consequent abundance of organic remains. The older trachytes are positively many of them undistinguishable from Auvergne, as are the white tufas, sometimes pumiceous. But the analogy which struck me most forcibly was a quantity of streaked and ribboned altered marks, like those which we found so numerous on Rigolet, and of which we took some specimens as curious instances of ferruginous yellow and brown stains. I was not so lucky as to get a shell in any fragment of this, but I found, on ascending Epomeo, the same occurrence of clays just like the conchiferous beds which form the fundamental strata of the island, as we found high up in Mont Dore marks like the queer Cypriferous marls of the Limagne. At last, at an enormous height, corresponding in Ischia to what the great cascade is in Mont Dore, I found, in a mass of this clay, marine shells unaltered, and belonging to the same class as those in the lower regions of Ischia. I feel no doubt

now that we were right in our speculations on the *pretendue breccia*, &c.; besides which, I have now the satisfaction of having an example of marine remains at a greater height than any of Brocchi's sub-Apennines, and belonging to a formation decidedly more recent. It is annoying to find that Monticelli and Corelli have been poking about, and buying shells in Ischia for years, and that they have not got half as many shells as I got during my visit, which amount to thirty species, without counting microscopics. The proportion of recent species is exceedingly remarkable. They alternate with the volcanic products of the old trachytic volcano Epomeo, which is surrounded by many minor volcanoes of a date comparatively as inferior as is that of Tartaret or Chaluzet to Mont Dore. At least Epomeo is to me as unintelligible as Mont Dore, and the others are as perfect as the craters of Vivarrais. Unluckily their lavas go straight to the sea in ridges, and then form promontories, and are nowhere cut by torrents; otherwise, as the date of some can be nearly determined, they would have been invaluable documents of comparison.

When I have seen the parasitic volcanoes of Etna, I will resume the conclusion as to Auvergne which Ischia suggested. I was much gratified by finding that the dikes of basalt and compact lava, which are so numerous in the great escarpment presented by Somma towards the Atreo del Cavallo, agree with the dikes of the Hebrides and the lavas of Vivarrais in presenting us with coal-black pitchstone at their contact with the intersected beds of scoriæ.

Necker[2] must of course have observed this, though I had forgotten it, but we must take care to insert his observation in our paper, or he will have a right to complain. It occurs in four or five dikes; an inch or two of pitchstone (obsidian) separates the vertical dike from the horizontal tufas and scoriæ through which it passes.

Vesuvius after the eruption of 1822 exposed seven dikes in the interior of the crater, quite analogous to those of Somma, but I am very sorry to say that the small sputtering cone which is now constantly filling up the interior of the

[2] A Swiss geologist, grandson of Saussure, who passed the last years of his life in the Isle of Skye.

great crater of 1822 prevents my descending to examine this splendid modern analogy.

Corelli has been writing on the present state of Vesuvius for two years, and never went down to see the dikes in the crater. Nay, he has not been up Vesuvius at all in that time, and Salvedra swears he was never up Somma in his life! Remember me kindly to Mrs. Murchison.

Believe me, ever truly yours,

CHARLES LYELL.

To HIS SISTER.

Naples: November 9, 1828.

My dear Eleanor,—My expedition to Ischia was of use to me here, for as I procured three times as many fossils in three days as they had ever got from the Isle, they regard me as a good workman. Costa, an ex-professor of Otranto, has named them all, so let the box go to the bottom, or the shells be annihilated by Douaniers, I will let the world know that the whole Isle of Isk, as the natives call it, has risen from the sea 2,600 feet since the Mediterranean was peopled with the very species of shell-fish which have now the honour of living with, or being eaten by us—our common oyster and cockle amongst the rest. Costa is to get my boxes of shells from Messina, &c., and examine many before I get back to Naples, which is getting work done rapidly, and will encourage me much. The grand difficulty in England is that our conchologists know nothing of fossils, but in a country where part or all of a formation contains recent species, this impediment is removed. My wish was to find this peninsula get younger and younger as I travelled towards the active volcanoes, and it has hitherto been all I could wish, and I have little fear of bringing a great part of Trinacria into our own times as it were, in regard to origin. Poor Costa, with several other naturalists of decidedly superior knowledge to any of the present professors in the university here, have been deprived of their chairs and persecuted to beggary for their 'constitutional' opinions. The police discovered lately that they were earning some bread by teaching languages, natural history, &c., and the

public were prohibited from employing them even as private teachers, so that now their ruin is complete. In all the great states of Italy except Tuscany, the inquisitorial suppression of all cultivation of science, moral or physical, is enforced with unrelenting rigour, and considerable success. Among eighteen persons shot for political offences, Carbonarism, &c., the day before I passed through Salerno, several were priests. On the road to Pesto I met three detachments of similar prisoners with guards. They were strung together by ropes, like those met by Don Quixote. The driver of my gig to Pæstum, an arrant coward, kept comforting himself on the number of troops sent to quell political disorders, and then came to me in the middle of the night at Eboli, to try to make me go in the dark, to take advantage of the French Ambassador's escort, who was going to visit the temples. As I wanted to geologise the recent travertins of the intervening plain by *daylight*, I did not stir till 6 A.M. The Temple of Neptune is the finest relic of antiquity I ever saw. The travertin of which it is built was in such enormous blocks that they cannot be used for other buildings, unless carved and cut, and this is far more expensive, as they are very hard, than quarrying fresh travertin. This I believe has saved them partly. The same size of blocks would enable them to resist earthquakes, which have troubled this coast; for when Messina was shaken down, the jail alone stood, built of large stones. I have not seen the spectacle inside of Vesuvius yet, for in high winds, which have prevailed, so many loose stones are detached, that the cone cannot be scaled, but I have done the geology pretty well, and boated it along the section of the cliffs of lava facing the Bay of Naples. Pompeii afforded me some good geological hints, besides, of course, much amusement and instruction. The paintings frescoed on the walls of some newly disinterred houses are in such Chinese perspective, and so many ages behind the bronzes and statues and alto-relievos in the same houses, that my faith in the excellence of ancient painting is somewhat shaken. The head man who was my cicerone there was ignorant to a diverting degree, not often the fault of Italian lionisers. 'This, sir, is the wife of Pompey the Great, named after Pompeii; she is weeping her husband's

death, who was killed at the siege of Troy!' I have, of course, seen the museum here of things found in Herculaneum and Pompeii. It is of great interest, but of less than it ought to be made, if the Government was spirited. Scarce a fourth of Pompeii, or a hundredth part of Herculaneum, is explored. There has not been enough done in excavating small private houses, and preserving the furniture. The innumerable bronzes and busts, &c., one sees equal and superior elsewhere.

Dr. Daubeny's[3] letter came yesterday, with many good hints on Sicily, and a joint letter from Dr. and Mrs. Buckland this morning is full of good practical hints, as well as scientific. It is a most kind service to have done me, for as they are persons who make no difficulties, I am sure that whatever they recommend is indispensable. So I have bought tea, sugar, cheese, and four bottles of brandy, which Mrs. B. says will keep off malaria, and their weak wine will not. It seems that even in winter this evil attacks those who *live poor*, and where inns are few and bad, you cannot live well unless you provision your mule. Between Messina and Syracuse lies all that is of the greatest importance to me, and I have still a fair chance of doing it before the December rains set in seriously. Naples is not so dear a place as Florence or Rome, for those who are a match for the natives. If you are inclined to be absent, as I am, it is a good place to cure you, for you must have your wits about you every moment. I asked yesterday if it was too late to frank a letter. 'No, sir; mind if it is to England, you only pay fifteen grains (sous).' I thought the hint a trait of character, as they are all suspicious of one another. The clerk demanded twenty-five. I remonstrated, but he insisted, and as he was dressed and had the manners of a gentleman, I paid. When I found on my return that I had been cozened, I asked the head waiter, with some indignation, 'Is it possible that the government officers are all knaves?' 'Sono Napolitani, Signor; la sua eccellenza mi scusera, ma io sono Romano.' When the Austrian troops retired, the king gave the officers a choice of any new uniform they pleased, and they actually chose the Austrian! After their dastardly stand, which

[3] Professor of Chemistry at Oxford.

followed all their vapouring about a constitution, I think this is as memorable a proof of want of national pride as was ever known. They are a very fine-looking people, and become the lion's skin far better than the troops from whom they borrowed it. There is a Virgin, with candles always burning, in almost every café and wine-house. The noise in the streets is dreadful. As in ordinary squabbles, men and boys bawl louder than our criers, all those who cry various goods for sale, quite deafen you, and as many are hoarse habitually, it is painful to hear them. They roar as if they would bully you into buying, and numerous idle boys spend hours in mimicking them.

I shall perhaps get to Rome still in December. With my love, believe me,

Your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Catania: November 29, 1828.

My dear Marianne,—After my successful expedition to Val del Bue and return here, I went this morning to see the Islands of Cyclops, eight miles from hence, and made a good cruise. The chief of these small isles opposite Trezza is to an ancient lava of ancient Etna what the Needles in the Isle of Wight are to the chalk of that Isle—detached portions in the sea. This, Virgil said, the giant Polyphemus threw at the Trojan fleet. It still remains, but is wasting so rapidly, that in some 10,000 years it will be annihilated. It consists of basaltic columns, like the Giant's Causeway, covered by strata of clay. I saw that same clay was on the mainland at the foot of Etna, and some peasants assured me, that it contained 'roba di diluvio,' so I hastened thither, and found 700 feet and more up Etna, in beds alternately with old lavas, sea-shells, fossils, but many I know of modern Mediterranean species. This is just what everyone in England, and at Naples and Catania, told me I should *not* find, but which I came to Sicily to look for—the same which I discovered in Ischia, and what, if my geological views be just, will be found near all recent volcanoes, and wherever

earthquakes have prevailed for some thousand years past. I have set a man and boy to work, at so much per day, and if they do their duty, I shall find, when I return from Etna, something that will fix the zoological date of the oldest part of Etna. I go up again to old Gemellaro's to-morrow at mid-day, if weather fine, to ascend Etna next day.

Catania, Nov. 30.—Dr. Gemellaro[4] called this morning, who has published on Etna. Confesses that he never hunted up the 'roba di diluvio,' because the shells they brought him were Mediterranean ones, and he supposed they were taken from the sea to strengthen walls!! A good joke, as I found them for miles, and in strata 100 feet thick! He is not a little annoyed at seeing of how much importance I think it. I shall start for his brother's this afternoon.

Nicolosi, Dec. 2.—I was most fortunate in my expedition to the highest cone. Old G. started me in the middle of a coolish night, by moonlight, so that we reached by daybreak the highest part of the woody region. There a fire was made of boughs from the old chestnuts and oaks, which, though one or two thousand years old, stand on *modern* lavas of the volcano. I had taken my tea-kettle, and, as a preservative against cold, made a breakfast of hot tea, following Captain Parry's advice. We did not cross much snow before Casa Inglese (9,000 feet high): then we ascended the cone. I had determined to think with Ferrara, who has published the best guide-book of Sicily, that the sickness felt from the rarity of air on the summit of Etna was all nonsense, but I had no sooner ascended 200 feet from the hut called 'Casa Inglese,' than my head ached, and I felt squeamish. My guide said, 'We must go slower; I have known many vomit violently during this part of the ascent.' The fact is, you go up gradually to the foot of the cone, your lungs get pretty well weaned of breathing more condensed air; but when you rise almost perpendicularly from 9,000 to 10,000 feet, the air within you is so condensed, compared to the atmosphere you enter, that you are ready to burst. Such

[4] Dr. Giuseppe Gemellaro, who lived on Etna, and published a map of the early eruptions. His two brothers also devoted themselves to the study of the mountain, and Professor Carlo Gemellaro contributed important treatises, one of which, published in 1858, was dedicated to Sir Charles Lyell.

vapours were issuing from the crater, that I saw nothing distinct in it; but from it I saw into the Val del Bue, a view which Buckland had begged me to make an outline sketch of, and which in about half an hour I effected, I believe decently. Inside the crater, near the lip, were huge masses of ice, between which and the scoriæ and lava of the crater issued hot sulphurous vapours, which I breathed in copiously, and for six hours after I could not, even after eating and drinking, get the horrid taste out of my mouth, for my lungs had got full of it. The wind was so high, that the guide held my hat while I drew; but though the head was cold, my feet got so hot in the cinders, that I was often alarmed that my boots would be burnt. I descended to examine the 'Cisterna,' a curious case of recent subsidence at the foot of the crater; then to 'Torre del Philosophia,' which overhangs the head of Val del Bue; then back. Old G. said, 'I congratulate you on having done this on December 1, for the wind has changed, and you are probably the last who will mount this year.' Accordingly this morning Rosario, my muleteer, called me, and said, 'Signore, Mongibello e bianco come una colomba' (they call Etna 'Gibello' in Sicily), and sure enough I found that down to the bottom of the woody region, for 4,000 feet, the mountain was one mass of snow, such a metamorphosis in eight hours! and sleet falling fast here. I am a willing prisoner, needing a recruit after such a fag, with a good library of books on Etna, and a companion who has made the volcano the study of his life, and who has published the only scientific accounts of the late eruption.

Nicolosi, Dec. 3.—Rain and snow. Old Gemellaro and his youngest brother (not Dr. G.) delighted to hear old stale news, which I read a month ago in French papers, of the Russian campaign, French politics, &c., for the Government lets them know nothing in Sicily. The young G. who has come here, finding I had only a brazier of charcoal in my room, has ordered a fire, God bless him, and I am at last warm. The elder G. is a kind of laird and chief magistrate. Cannot talk French or English, so we talk half Latin, half Italian, and so always get on with one or other. He is really a good Latin classical scholar.

Catania, Dec. 7.—Left Nicolosi December 5. Visited only a fine instance of a lava of Etna, cut through by a river which it had crossed. Took a peasant for a guide from Aderno, a stupid officious bumpkin, whom I could not persuade to stay with my horse, while I went down to the waterfall. The lad, I believe, wanted to see what the devil I wanted to look for, so having, as he assured me, secured the beast, and tied him to a great stone, he came with me. After exploring, I became anxious, and told him to look if the steed was safe. We climbed a rock, and saw he was just as we left him, but the nag, who was weary of standing still on a lava current, no sooner caught sight of us, than he plunged and pulled till he broke loose. He fancied we were on the opposite bank, as we appeared to be, from the winding of the river, so he plunged into the stream to join us. It was the Simeto—the old Simethus—the only one in all Sicily which deserves to be called a river, in a narrow gorge, a violent current, and just above a cataract. I thought it was all over with him. The saddle-girth gave way, and down went the saddle over the waterfall; but the horse was a powerful creature, and landed safe, neighing all the time with his head turned to me, but he could not climb up the steep rocks on the other side. When I got down opposite him, he wanted to cross again to me, but as it was too dangerous, I prevented him with stones. I found the lad frightened out of his wits, and got at last in such a rage with him, that I threatened to throw him into the river, upon which he went off for assistance. I waited for an hour, when I saw two woodmen coming on the opposite cliff, who descended by my directions to the horse (the gorge was somewhat like the Isla at Airlie Castle, but less high). They actually had to construct a path, and got him up with great difficulty. In a word, he was not wounded, and we found the saddle, stirrups and all, floated three-quarters of a mile down in the middle of the river on a rock. The steed was brought over a ford, and I only lost three hours and a half, and 3s. for the men. I did some geology the same day, but could not reach Catania. Night comes on here like an eclipse of the sun, all in an instant, without twilight. The roads are getting horribly muddy. Rosario advised sleep-

ing in a low inn, or rather stable, with the horses, twenty-five mules in the same, half of them loose. I dreaded a kick. 'No fear,' said he; 'you shall have clean straw, and I will sleep between you and the horses!' I insisted on proceeding to a village two miles on, which we reached at last. I went (*à la Murchison*) to the Pharmaçia—the apothecary always sets up for a *savant*, and is much flattered at being applied to for scientific information. After some talk, he sent all over the village, and at last procured me a bed, better than Aderno, for the inn there was vile enough. In a country where they have nine months' heat, there are no protections against cold. When I ordered a fire at Aderno, they brought a sort of garden flower-pot, broken, with some charcoal, for there are no chimneys. 'Have you not another? This will not warm the room?' 'Yes, sir; but you had better not, for you will be stifled.' 'Impossible! One might as well talk of being stifled in the open air as here, with four doors, not one of which shuts close.' 'Four doors, sir! Bless me! Maria Santissima! Why this is only one opening into another room, and this into a passage; and this, sir, is the door, and this a window.' Now the last you must know was an opening with two shutters, for except in the capital towns of provinces the inns have no glass; so if you want light you must open the shutter, and let in rain and wind too. Rosario understands the commissariat department, and though the room is bad, I am never without prog. He believes in all the saints and miracles. I forgot to say that when he heard of the horse's escape, he crossed himself and said a prayer. When he learnt how he was got up the rocks on the opposite bank, and when long afterwards I related how the saddle was recovered, he drew his bridle, crossed himself, and said another prayer. On my return here, I found I was elected honorary member of the Geronian Society of Catania, the only body which publishes any memoirs on natural history and philosophy, and theirs are very respectable. If detained by rain, I shall make use of their library, ours I should say, and reading-room.

Ever your affectionate brother,

CHARLES LYELL.

To His Sister.

Syracuse: December 11, 1828.

My dear Caroline,—I passed over the plain of Catania, a delta of the Simeto, early, following the sea-beach, near which were hedgerows of Indian figs and aloes. Before the sun rose from the sea, all the snow of Etna was glowing with red, like another dawn in the west. I have seen this sight three times, a proof of fine weather and early rising. Slept at Lentini; inn good, for Sicily; glass window, and really not many panes broken. Next morning the churches began as usual to fire their batteries. They cannot pray in this isle without gunpowder. In Catania I was opposite the Duomo, and the smoke and din were most warlike. About fifty 'maschi' are set in a row—small short iron tubes, with touch-holes—and a man or two stand with long canes lighted at one end, to fire them one after the other, like a *feu de joie*, the instant the priest has said the benediction. A greater gun is often put in the middle or end, according to the fancy of different churches. One night at Catania I heard a drum and two clarionets, followed by a rabble, shouting and throwing up squibs and fireworks. 'What is this?' 'Per la gloria della Vergine.' 'Della Vergine?' 'Siguor, si, della immaculata.' When I reached Syracuse, it was the first of thirteen days' festa in honour of Santa Lucia. 600 'maschi' were let off in the piazza. As the Sicilian gentry are great sportsmen, they send their steeds to face the battery, for if they stand this they will not easily flinch from a gun. So the groom rides up, and the town boys stand behind with whips and switches, to prevent a retreat. As they stand a good chance of a kick, and hope to see the grooms thrown, they are never tired of this sport. The horse rears and plunges his nose in the smoke, with the noisy mob behind, and I could not help thinking what religious associations the lads must acquire in regard to 'maschi.' From Lentini to Melilli. I had a letter to the vicar, a *brother*-member of the Geronian Society. His invitation to sleep there was such as I did not choose to accept. The room I got (for inn there was none)

was a queer place, and everything to be begged and borrowed but the bed. Next day I found that a crater discovered by the priest was a circular valley cut out of *limestone* strata, with three veins of volcanic rock through them. I must write to Dr. Gemellaro, for if he publishes this in the transactions of a Society at the *foot* of Etna, it will be a joke against them they will never get over. Went to Sortino, to see grottoes of Pentalica, where a vast population once lived underground. Made a man dig, by Buckland's direction, into stalactite, but the instrument was so bad, I was obliged to go away after four feet were dug into, and no signs of a bottom, or bones. Got too late to enter the gates at Syracuse; such bogs as I have had to get through! No funeral ever went slower than we for two days, and some fords not quite so shallow as could be wished. After seeing the paths called roads, near the great towns in Sicily, I shall respect the worst in the Grampians, and honour the muddiest road in Angus. It requires force to extract the hoof, and a leap to jump down the stones. In summer they go by other tracts, now bogs which would swallow us up. At Floridia, a small town near this, they showed me a room to which the caves I had seen at Pentalica would have been luxurious, so cold and stinking; so off I went, determined to beg at the best house. There was only one with two storeys, a Pharmacy, and the owner, the Mayor or Syndico, a Maltese, who gave me an excellent apartment, was glad in return to hear stale news which I had read a fortnight before at Naples, the taking of Varna, &c., and he told me of some new antiquarian discoveries at this city, and then politely left me alone. Rosario brought everything for dinner, and I gave the servant what a bed would have cost—a shilling—and got here to breakfast in light rain, yet have geologised and antiquarianised all day with much success. An old monk, who collected shells and fossils, died lately, and I purchased the latter for a trifle; not many, but good, and more than any other geologist has got to throw light on the old volcanoes of Val di Noto.

Licata, December 16.—From Syracuse by Noto to Cape Passaro, and then, to avoid some fords which the rains had swollen, by *Spaccaforno* to *Scicli*, *S. Croce*, *Terranuova* to

Licata; to-morrow to *Girgenti*. Beautiful weather for seven days, and I have made such progress in the geology of the isle, and have such a near prospect of completely mastering the difficult points, which no one ever did before, that I mean after the late fine weather to penetrate to *Castrogiovanni*, which I had entirely given up. The inns are execrable beyond description, and bread often requiring all the digestive powers which I have gained by being on horseback for ten successive days for eleven hours each.

Girgenti, December 18.—An uncomfortable inn at *Noto*, but next day threatened with so much worse at *Pachino*, that in spite of Rosario's remonstrances I pushed on to *Capo Passaro*, but the old priest who had received the Bucklands was dead. His young successor however, a simple frank young man, welcomed me in a dwelling like a humble Scotch Highland manse, and cold enough. Saw the fine rocks of the Cape that evening, and again before breakfast, and then on to *Spaccaforno*. My man had built on my staying, because the *wind* was very high, and turned out sulky. No inn at *Spaccaforno*, a great place bigger than Salisbury. Went to the Jesuits' convent. 'Would have been happy, &c., but the Bishop was arrived on a triennial visitation, and they and the Carmelitans crowded with his suite.' Went to beg of the Mendicant Capuchins. 'They had a room vacant, but the beds were all ordered off to the other convents for the Bishop.' At last Rosario made them understand we should pay as at an inn, and a monk gave me his cell. Such a villanous place, hardly room for a small bed and table; unswept, &c. The bread here and next day black, and half baked, and scarce digestible, and no meat, not even a fowl to be bought. Population 9500! Most of the brethren rude and uncouth. My host quite otherwise. On my complaining of the wine we had procured, he went out and came back with a bottle under his cowl, and a cheese. I thought of the friar in 'Ivanhoe,' but unluckily for my dinner, and the joke, both kinds of prog were very bad. He made a decent show next day of not having expected payment, but I said it was to sing masses for my soul. Next night on to *S. Croce*. Road horrid; no inn, but a camera attached to a 'fundaco' or mule stall; and as you may be obliged to sleep

in the latter, this chamber ranks here in a muleteer's estimation as respectable. Each of the dirty family sleeps in it by turns, and turns out for the stranger. The cobwebs were thick and pendent, and the hostess said, 'Cercate, Signor, ma non c'è altra,' with such an air of presuming on her monopoly, that I applied to the Syndico, who ordered me an apartment belonging to the commune. It was decent but gloomy. Next night, at *Terranuova*, I petitioned for more bedclothes at the inn. 'Non c'è altra coperta, Signor.' 'Can't you borrow one?' 'No.' In such weather in Scotland you might do without fires, but here the houses are planned for being cold. The sun is very warm from 11 to 2 o'clock, even a few lizards out, and *Papilio cardui*, *edusa*, *phlæas*, *brassica*, and *rapæ*, and the moth *popularis* (all British), without any foreigners mixed. Many flowers in full bloom, a blue iris, daisies, marigold, rosemary, and numerous splendid shrubs by the sea-side, some of which I remembered in the garden at Bartley. The olives are old and picturesque, and their light green, and the rich green of the Carubiere,[5] with very rarely a deciduous tree, make it quite unlike winter in appearance. As the inn at Licata yesterday was the best since Syracuse, I did not sleep, as I might have done, at a rich merchant's, Mastroeni, to whom I had a letter, but went to a soirée there, very gay. Saw the fine old Doric temples of Agrigentum on my way to this,—fine geological sections near them. I found the people here, as indeed I had found them everywhere in Sicily, celebrating a festa, but the cause was novel. Eleven years ago the citizens and populace threw down the King's statue, and broke every limb to atoms. His Majesty, of his royal clemency, bethought him, eleven years after, of punishing them by transferring the tribunals to Caltanisetta, a smaller city, where a powerful garrison kept all loyal, as they did in *two* other places only, in *all* Sicily. Hearing of this threat, the magistrates ordered a new marble statue from Palermo, which was being set up when I entered. But the fatal decree arrived first, so the senate, to propitiate the King, ordered a three days' festa, and all the usual ceremonies are to be performed before the statue, while they are to obtain inter-

[5] *Ceratonia Siliqua.*

cession of a patron saint when they carry out or go in procession to the image of the Virgin, or their protector St. John. The *Bishop* and clergy attended, and sung solemn mass; maschi were fired off, and in the evening above a thousand were to be exploded. Service also in the cathedral. I looked in, and while the people were on their knees, the organ playing and the bell sounding, in came a military band playing a *march*, while a file of soldiers fired off a volley just within the porch, and made a terrific noise in the Gothic aisles. There was to be two more days of this, and they still hoped that when the King heard of such devotion he would relent and reverse his decree. The Sicilians have the character of being very sincere among Italians, and compared to Romans or Neapolitans I believe they are so. The King and Government are unpopular, and the former known to be a mere gourmand and sportsman, yet what did the Roman senate of old ever do more servile when they decreed divine honours to Augustus and other living emperors. I forgot one droll sight. Fifteen orphan boys were paraded before the statue stark naked on a windy day, and then clothed by the Bishop in the name of the King.

Ragusa, near Modica, December 25.—From Girgenti I rode through the heart of the island by Cannigatti, Caltanicetta, Piazza, and Caltagirone, to Vizzini, within a day of Catania again, to get new sections of the old limestone and volcanic district of the Val di Noto, and decide the difficult problem whether the rocks of the east or west of this isle were first formed, for certainly they were not contemporaneous. I do not wonder so many have doubted, for the convulsions have been tremendous, though the strata, geologically, is very modern. I have made up my mind on the subject, and am glad I returned, though I half repented when I found in so many large fine cities such wretched accommodation, especially on two of the days when I did less geology than on the coast, but the Val di Noto redeemed all. The centre of the isle is without wood, downs, with grass and wheat on clay soil, the latter a few inches high. It ought to be 1½ feet, and the farmers are alarmed at the extraordinary want of rain, which has been so favourable to me, as the clay districts have become hard again. Short as are the days, ten hours or less,

Rosario says that few English travellers can ever work more hours daylight, for they are obliged to be indoors in the heat of mid-day, as in other seasons. Near Piazza, where there was no geology, I went after an *Hipparchia*, the first I had seen. It was *pamphilus*, and I also saw *Magœra*. Rosario must needs imitate me, and has really acquired so good an eye for a fossil shell as to be of great use. He dismounted, caught a *pamphilus*, and holding it battered 'twixt finger and thumb, pronounced after a stare this notable opinion: 'Questo e un grillo alato, ma ce ne sono in Sicilia che volano senza ale.' Shortly after this he was pitched headlong over the mule's head: his hand swelled with the fall. I conclude he was snoozing, though he gives another explanation. He tells me I am taken for a merchant travelling for *trovatura*, or treasure-trove, and the peasants offer themselves for guides to the grottoes where the Saracens are said to have left enormous treasures, but where no one has yet had the art to extract anything. At Palagonia the best room was occupied by a Sicilian baron. Innkeeping must be a bad trade, as I had never found the best room taken before, so I was given the barn. Had it been a windy night I should have suffered much. Here the loft of the inn was so small, and had been uncleaned for so many years, that I went out and applied to the first peasant I met. He showed me his cottage, very clean and comfortable, gave me the key, and left me and Rosario in full possession. Most of the inns in Sicily must have been designed for travellers below the rank of ordinary peasants, judging by the comparison. I got a good many shells at Caltagirone, most of any place since Syracuse. Not a drop of rain now for fifteen days!

Palermo, December 31.—Arrived to-day, somewhat fagged, but the beautiful appearance of this city and the fair promise of the inn have quite set me up; and as I shall be busy every moment till I sail for Naples, I will employ a few minutes, if but to tell you that in the honest peasant's bed above mentioned I slept not, though tired, ten minutes in the whole night. They had added, at my asking for covering, an old blanket, in which were more fleas than all the insects in our collection, and I suppose they had starved since last winter, for next morning I was marked all over from head to foot

with red spots like one of the Ancient Britons with his body painted. I never passed such a night since I had the measles at Sarum, yet the host and Rosario thought it a capital joke, and I heard them laughing about the 'pulci' having found a piece of 'carne fresca,' and they gave me pretty clearly to understand that they thought one who could not stand a fleabite was unfit to travel. Rosario must needs pull out the blanket, to show where they were sleeping next day, and they were in thousands, yet the owner and his wife use this blanket without inconvenience when it is cold.

I shall send Fanny a letter from Naples or Rome, in which I shall write some adventures of the last part of my tour, that you may have a complete idea of the luxury in Sicily; which, however, as far as my objects are concerned, has answered remarkably well, and for the time has yielded more than I could have expected.

January 1.—A happy New Year to you all at Kinnordy. With love to all, believe me, your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Palermo: January 1, 1829.

My dear Fanny,—I find that I ante-dated by two days my last letter to Caroline, and wished her a happy New Year before the old one was over. I was glad to find, when the cannon of this port fired a grand round at daybreak, that I had two days more to get back to town, which I hope to do before February is over. As for the two seas and the Alps which lie between England and me, and the vetturinos, and the winter, they all seem trifling inconveniences to me now, after five weeks' roughing it in Sicily, for I am sure it will all be luxurious comparatively. As they say that those parts of a tour read best which were least agreeable to the traveller, I shall go back to *Ragusa*, though you must not flatter yourself that you will hear of banditti, for every part of the island I went through, and that was about two-thirds of the whole, was, I am sure, as safe as the best parts of England. However, I believe I may absolve Scrope and others who wrote me discouraging instructions on this head

about the prudence of taking pistols, a fierce dog, &c.; for when they were here, the late revolution, by suspending all law for a time, had rendered highwaymen numerous. Rosario saw twenty-six shot in one day, and being courier then, was allowed additional time for the letter-carrying, as he often went round, to avoid dangerous places. There is a strong military police now, for the poverty and misery of the population are at their height, and without a strong force to suppress them, they would be more honest than any in Europe if they did not turn robbers. I found that a chief of banditti from the side of Marsala (where I was not) has just been taken here, and shot, they tell me, without trial, a Turkish proceeding, but I hope this is not correct. These men were convicts in the islands off here, who escaped. Guidotti of Parma, a somewhat timid gentleman, never expects me to return, as a Prussian naturalist of his acquaintance was murdered three years ago. I learn that it was his own guide who was the assassin, and he the only traveller who for many many years has suffered. The population of Sicily is not one-fourth of what it was once. Syracuse alone had a number equal to the present total, yet the Greeks were always fighting each other, town against town. But they were active, industrious in commerce, and every acre was cultivated. Now one-third of all the land belonging to the convents is ill-cultivated, for the friars never reside long enough in one convent to acquire a local interest. The bishop changes them from one to another, as often as they quarrel with him, or one another. Another third of land belonging to the nobles is said to have been also much neglected. But a strange revolution is going on. The old law of primogeniture is abolished, and the French system established of equal division, males and females. As this is only eleven years old, it has only begun to take effect, but the rich Prince of Paterno died lately, and I found the inn full of land surveyors, estimating his lands, which had been divided into eight portions, and many were selling their shares to Catanian merchants. The nobles were against the king in the revolution, and it is now the policy of the court (a short-sighted one, no doubt) to degrade them. The taxes are complained of as very exorbitant, raised to pay the debt

incurred by the Austrian occupation. After my sleepless night at *Ragusa*, mentioned in my last, I went to *Castrogiovanni*, and on my way was revived by finding in some marls some fine impressions of fish, the first fossils hitherto found in the formation which produces sulphur and salt in Sicily. This will, I am sure, be of no small interest to Buckland and Daubeny. I found the same again in four other localities on my first two days' journey from *Castrogiovanni* to *Palermo*, when at length I rejoined the carriage road, and continued on it for three days, making, in my whole tour, exactly five days, that I was on a road on which any machine with wheels, however rude, could move. Not that Sicily is at all unfitted to have beautiful roads at the same cost as any other country. As I had good reason to suspect that Rosario was planning being a day longer than I intended, I rode on before one day, starting early, and the night and the rain came on, and he could not quite come up with me. So besides the ordinary luxury of a Sicilian inn at *Rocca Palumba*, I had the benefit of a night without my baggage and portable provisions. But next day reached this, and no sooner had we arrived, than heavy rain, snow, hail, and thunder came on incessantly. Fords that we crossed daily during the last fortnight are now impassable, and journeys which we performed in a day, with as much ease as it is done in summer, are now two days' hard work through the clay and bogs. Yet this rain *ought* to have come three weeks earlier. The American Consul, Gardner, has given me some beautiful fossil shells. I drank tea there, and was glad to see again a regular English fireside and tea-table.

January 3.—Made acquaintance with Professor Ferrara; learnt much about earthquakes; bought his books; dined at Lord Northampton's. The Marchioness finds good marks for her wit in the numerous and illiterate princes and dukes who pay great court to them. I learnt much of the state and feeling of the Sicilian *noblesse* by her criticisms. I have been to see the convent of the Capucins, where there are great vaults full of dried bodies. What an Egyptian piece of superstition! Dukes and bishops, &c., dried, and in coffins; monks and paupers innumerable, dried and set up in their clothes; some 150 years old, ghastly spectacles; long files of

these mummies, ten times more frightful than skeletons. These Capucins give soup to a hundred or more beggars daily. The mendicity here is distressing, not a noisy set of idlers making a trade of it, as at Naples, but the misery of a starving population; children exposed in frightful nakedness positively howling at night in my street, and now and then well-dressed persons begging piteously. This faithless packet will never sail, they always promise solemnly to-morrow. A bad cold and slight sore throat, and my impatience at being detained, makes me low-spirited.

January 5.—Bought some good fossil shells, saw the museum, cathedral, &c. Cold worse, captain will not sail, and threaten him to wait for steamboat. No keeping warm without stifling oneself with charcoal. The merchants here are gloomy about the end of the war, for they say the Black Sea will be open by demand of all the Powers, and their corn will sell no longer. The retreat of the Russians from Silistria is the theme of politicians.

January 6.—The wind fair, and the scoundrel will not budge, for he is afraid as long as there is a cloud. Steamboat expected. Dined with the Northamptons. Met some Sicilians. The old lady made me go to the play with her and her unmarried daughter: it was one of Goldoni's, by good luck, and we got back to tea, and I had a talk till 12 o'clock with Lord N., who reads up to the day, and is a most agreeable companion. I had not exhorted him in vain to collect fossils, his old hobby, and he has already got some, and taken full instructions. Among other things, he means in February to go to all my localities of fish, and will probably send for Rosario as a guide from Messina. Lady N. gave me a hint, as from experience in Sicily, that I should often have slept sounder if I had had some straw taken from the rick, and slept on it in my cloak, which I shall remember another time in southern regions.

January 7.—Is it not strange that the best houses belonging to Sicilians have no fireplaces or chimneys ? yet the snow now covers the hills which overhang the rich plain in which this beautiful town stands. The Northamptons have built, since their arrival, chimneys in all the rooms, and famous fires they make, to the great satisfaction of the natives. They

have got a beautiful mansion. Almost all those of the nobility are now let out in floors to merchants and others! Wind fair, and cannot get away. The excuse is infamous, after so many promises. 'Prince Butera has not yet sent his horses to embark!' The diploma which I found for Scrope and myself, from the Geronian Society of Natural History in Catania, must have been devised by a 'Lepidopterist,' as Stephens would say, for among the emblems, a great butterfly at the top cuts a greater figure than a range of basaltic columns at the bottom.

January 10.—Gulf of Naples, on board 'Costanza' brig. Although the steamer arrived on Thursday, my impatience to be moving brought me on board, but instead of sailing at midday, we were kept five hours, a fair wind blowing, waiting for a passenger who never came. This lost us just a day, for we kept the wind till the middle of last night, and were then opposite the Isle of Capri. Three hours more of it would have taken us to Naples. After eight of dead calm, we moved on one mile per hour, the whole of to-day, then six miles the last hour, which brought us in at 24 o'clock, *i.e.*, 6 o'clock, or sunset, and the blessed police will not allow our landing till 8.30 o'clock to-morrow. 'Basta che siamo nel porto, Signor,' says the captain, coolly. Vesuvius, since I was here, put on a covering of snow down to the middle, which seems great presumption for a monticule not much higher, I fancy, than those of Glen Isla, and in this climate. I am the only passenger in the best cabin, and my knowing how crowded the cabin in the steamer is, was one of the principal causes of preference. But this is as rough as the interior of Sicily, and no bedclothes but a blanket, which is a bore, now a third night is added so unnecessarily. Talking of rough work, there were two things of which I deemed it advisable to break my valet Rosario. First, not to bring in the salt in his hands, often none of the cleanest; and secondly, not to stuff the meat remaining after dinner, and intended cold for next morning, into my slippers, without at least some paper round it. From these he desisted, but a few hints on minor subjects were met with, 'A la guerra come a la guerra!' in which he was right as a traveller in his isle. We had quite a gale for the first twenty hours, nine

knots an hour, without a sail but two very small ones. I was very ill, but recovered so as to read and write ever since.

Your affectionate brother,

CHARLES LYELL.

To RODERICK MURCHISON, ESQ.

Naples: January 12, 1829.

My dear Murchison,— Thrice did I entreat the lazy rascal who is intendant of the post at Palermo to look back over the letters of a month before, as I knew I had some waiting. I now find to a certainty, from the post office here, as well as the landlord of the hotel, that no less than three letters were there for me. As I have never once heard from home since we parted, I cannot tell you how great my disappointment was, after being kept nine days in Palermo. They must now travel after me to Paris. One of them no doubt was yours.

I have so much to tell you, that where shall I begin? My last letter was from Licata. Thence I went to Girgenti, and found that, notwithstanding what the Catanese said to the contrary, Daubeny was most indisputably right in identifying the calcareous breccia, as he terms it, of that place, with Syracuse, and as I afterwards found of *Castrogiovanni*. Then this formation (indubitably far, very far more recent, than the sub-Apennine beds) attains the prodigious height of 3,800 feet! I got so astounded by the results I was coming to, in my tour from Etna, round by *C. Passaro*, that I began to doubt them; and not without some struggle with my desire to get out of the inns and horse-paths and other evils, I struck back again to Val di Noto right through the centre of the isle. I found, as I believe I told you before, that the so-termed Blue Clay formation must be divided into two very distinct and in some cases unconformable deposits. The upper resembles the blue sub-Apennine marl, covered near *Caltagirone* with its true Sabbia giallonula. The lower is without shells, white marls, beds of gypsum just like those we saw at *Cagliari* from *Asti*, beds of sand and sulphur, rock salt, &c. Now in the foliated marls (white) of this last formation, after searching in vain on the sea-coast, I

found at last organic remains. First near Radusa, a small hamlet in the interior, where fishes' scales, and some entire fish like M. Bolca, turned up, and some impressions of leaves. Whether fish be marine or freshwater, I cannot say. Thirty miles off, near *Castrogiovanni*, and in three other localities between that and Palermo, I found the same fish in the same beds. But the first marked locality, only four days' ride from Palermo, is the richest, and would probably prove a M. Bolca with some labour, *i.e.*, if the formation be not lacustrine or fluviatile, against which I know no argument yet. As a whole, it is uncommonly like our Superga *marls*, not a grain of green sand however, but positively identical with the beds I saw in my solitary expedition on the *cheval de poste* to the gypsum beds of [name omitted], where also I found laminated marls with leaves between two gypseous strata. But these are mineralogical identities, and go for nothing. What will you say if I tell you that even the blue marl with its capping of yellow sand cannot be Brocchi's sub-Appenine beds? I am come most unwillingly to this conclusion. But the numerous extinct species which characterised the sub-Appenines are wanting here, and living shells are present too plentifully to admit a doubt that it is more related to our own epoch than that remote one when the Parmegiano and Placentino beds were deposited.

I think from what I saw at Pæstum and elsewhere that O. d'Halloy strained a point to make out some travertin older, but if I can find a day for Tivoli without hard rain, I will get more data. In the meantime, Sicily will throw all such proofs in the shade. I am much disturbed in mind about Siena, and must go there from Rome, to try and satisfy myself. My notion is that the *tout ensemble* of shells there will not be that of the Parmezan. I am beginning now to be able, when I see large collections, to distinguish between any marked difference in the proportion of lost species and genera. Sicily is as unlike *Asti* as possible, though there are some lost species in the former. I should build no system on such glances, but it might check me from reasoning too fast on the data obtained from zoologists as to Ischia and Etna.

We must preach up travelling, as Demosthenes did

'delivery,' as the first, second, and third requisites for a modern geologist, in the present adolescent state of the science. De la Beche is going just when he should.

Yours ever most truly,

CHARLES LYELL.

To RODERICK MURCHISON, ESQ.

Naples: January 15, 1829.

My dear Murchison,—I leave for Rome to-morrow morning, and shall be there the day after. The rain is incessant and tropical. I have got *all* my shells named, except some which *unfortunately* I sent direct from Palermo. The results of my Sicilian expedition exceed my warmest expectations in the way of modern analogies. I will tell you fairly that it is at present of no small consequence to me to get a respectable sum for my volume,—not only to cover extra expenses for present and future projected campaigns, but because my making my hobby pay its *additional* costs, which it entails, will alone justify my pursuing it with a mind sufficiently satisfied with itself, and so as to feel independent, and free to indulge in the enthusiasm necessary for success. I shall never hope to make money by geology, but not to lose, and tax others for my amusement; and unless I can secure this, it would in my circumstances be selfish in me to devote myself as much as I hope to do to it. I have little fear of accomplishing so much, and with that view, the instant our Auvergne paper is off our hands, I shall set steadily to the task. My work is in part written, and all planned. It will not pretend to give even an abstract of all that is known in geology, but it will endeavour to establish the *principle of reasoning* in the science; and all my geology will come in as illustration of my views of those principles, and as evidence strengthening the system necessarily arising out of the admission of such principles, which, as you know, are neither more nor less than that *no causes whatever* have from the earliest time to which we can look back, to the present, ever acted, but those *now acting*; and that they never acted with different degrees of energy from that which they now exert. I must go to Germany, and learn German

geology and the language, after this work is published, and before I launch out in my tables of equivalents. I shall, I expect, get out my book before the tardy G. S. gets out our Auvergne paper; but no matter, as I shall always refer continually to the MS. as read, and 'ordered to be printed.' This year we have by our joint tour fathomed the depth and ascertained the shallowness of the geologists of France and Italy as to their original observations. We can without fear measure our strength against most of those in our own land, and the question is, whether Germany is stronger. They are a people who generally 'drink deep or taste not,' &c. Their language must be learnt; the places to which their memoirs relate, visited; and then you may see, as I may, to what extent we may indulge dreams of eminence, at least as original observers. If I can but earn the wherewith to carry on the war, or rather its *extraordinary* costs, depend upon it I will waste no time in bookmaking for lucre's sake. At least I will answer for myself for many a day. Try to get me off being V. P. G. S., if intended again. I have, as you have, sacrificed something to official duties, and I am prepared to do so again at some future time, but I will not *for the time coming*, except as referee and councillor. As Sedgwick is to be President, there ought to be working V. Ps, and Fitton ought to be free now, he has done so much. I have a deal to tell you of news in geology, which the relation of what concerned me more nearly has left no room for, but you shall hear from Rome.

Ever yours, most truly,

CHARLES LYELL.

CHAPTER X.

JANUARY TO DECEMBER, 1829.

ROME—NEWS FROM HOME ON GEOLOGICAL SPECULATIONS—DR. WOLLASTON'S DEATH—TIVOLI—GRAND SECTION OF TRAVERTIN—GEOLOGISTS AT GENOA—JOURNEY TO GENEVA—DE CANDOLLE—NECKER—PARIS—LECTURE OF PRÉVOST'S—CUVIER—ARRANGEMENT OF HIS LIBRARY—RETURN TO LONDON—LIVELY MEETING AT THE GEOLOGICAL SOCIETY—FOSSILS IN PAVEMENT-STONE IN FORFARSHIRE—SEDGWICK AND MURCHISON GEOLOGISING ABROAD—LETTER FROM CONSTANT PRÉVOST—PROJECT OF GOING TO ICELAND.

CORRESPONDENCE.

To Roderick Murchison, Esq.

Rome: January 17, 1829.

My dear Murchison,—In the diligence I had time, as we travelled from Naples, to re-read your letters. I believe all you mean by modifying the caveat is to avoid our appearing to announce as *new* an old well-known fact of lava currents. This is well, but the *caveat* part remains necessary. Your term 'stone walls' is forcible, and not too strong, and should be inserted with 'as if between two,' or something in that way. I am anxious, as I told you, to throw off our principal paper, to clear the ground for other work; and, besides, I should like them to see that *we* do not require a year or two to hatch our materials. We will write it for reading, just as if we expected it to be put into the printer's hands the day after. That miserable old style of making a difference between a paper 'to be read' and one 'to be published' has, we know, been the secret of retarded volumes, overworked editions, and dull thin meetings, and it is very bad economy of time in authors.

Getting eighty species (only part of my Palermo collec-

tion) named at Naples, enabled me, by working in the museum of their Academy, to identify a great part of the tertiaries of Calabria with certain parts of Sicily, chiefly with the tertiaries of Messina, which are in that island of very limited extent. I shall write a letter from hence to Lord Northampton, telling him that when he arrives at a hundred species, it is only his starting point, as I was there. He will be glad to hear the news of the scientific world, in yours and Fitton's letters. I do not despair of stirring him up to such a point, that he will send to town 300 species before spring, which will ensure me against the chance of having to renounce my present opinion on the proportions of Sicilian tertiaries extinct and identiques.

Rome, January 19, 1829.—There is a deluge of rain here, after the drought. All tell me that I might have gone ten years to Sicily, and not experienced the same absence of rain in the same season. What with the fine season in Auvergne, and all summer and autumn, was there ever a greater proof that Providence watches over geologists? The chief danger, perhaps, in philosophical subjects is, that the majority may feel them cold, and without sufficient excitement. Mix up with this abstract quality a little human passion, a slight dose of personal interest, and you draw in ten times as many who look into the thing, and some of them come over to you, and transfer the stimulus at first supplied by extraneous considerations to the real subject itself. Truth once perceived, never I am persuaded wanted supporters in this world, even if men were sure to be losers by their support. The only difficulty you have to struggle with is the enormous indolence of mankind, who will never look into evidence till goaded on to it by some stronger motive than the mere love of abstract truth. I speak of the *οἱ πολλοί*. Do not build too much on the Col de Tenda section, for next to the green sand I believe the pretended universality of the 'New red' to be among the emptiest bubbles in geology. I have just learnt from Scarpellini, the astronomer, that Brocchi's *compagnon de voyage*, Ricasoli, is in Rome, and has some collections made in that tour, and I am to beat up his quarters forthwith. Ever most truly yours,

CHARLES LYELL.

To His Sister.

Rome: January 21, 1829.

My dear Marianne,—Although I cannot write you a long letter, I will not leave this for Siena, for which I start to-morrow, without acknowledging yours, which I was very glad to find here. My letters from geological friends are very satisfactory, as to the unusual interest excited in the Geological Society by our paper on the excavation of valleys in Auvergne. Seventy persons present the second evening, and a warm debate. Buckland and Greenough furious, *contra* Scrope, Sedgwick, and Warburton, supporting us. These were the first two nights in our new *magnificent* apartments in Somerset House. Their letters are all full of Dr. Wollaston's last moments, whose place they justly observe there is no one to supply in town. He has left 2,000*l.* to the Royal Society, and 1,000*l.* to the Geological Society, a bequest, as Fitton says, which although of great consequence in itself, will do us more good as showing the deliberate approbation of such a mind. I will send you, when I return, Murchison's two letters, with the account of the discussion on our memoir, which will amuse you. It is a very small part of our work. I am pledged to set steadily at the rest the moment I return, and expect that one month will do it, for M. has got all the organic remains named, and the mechanical work over. Longman has paid down 500 *guineas* to Mr. Ure of Dublin for a popular work on Geology, just coming out. It is to prove the Hebrew cosmogony, and that we ought all to be burnt in Smithfield. So much the better. I have got a rod for the fanatics, from a quarter where they expect it not. The last Pope did positively dare to convoke a congregation, and *reverse* all that his predecessors had done against Galileo, and there was only a minority of one against; and he instituted lectures on the Mosaic cosmogony to set free astronomy and geology. How these things are so little known in Paris and London, heaven knows. They are golden facts, and I find the state of the question here to shame the Granville-Penn school of England. I have had great light thrown on Sicily and

Auvergne by the travertins of *Lakes Tartari* and *Tivoli*. On a fine day I saw the cascade, then full of water. I find the marine formation here just the same as Sicily, a new light to the geological world, and I have now got full proof that half Sicily was formed since the Mediterranean was inhabited by present species of testacea. The present Pope is a bigot, but has quite failed in sundry attempts to undo what the last great man effected. He issued an order, which was positively published, to shut up the English chapel, but our Consul waited immediately on the Cardinal Secretary, and said he must, if the news was true, in pursuance of his duty, send off a messenger to St. James's; but he hesitated till assured again, for he wished to remind his Holiness that there were numerous Catholic chapels and churches in London, and although he would not take upon himself to say that his Britannic Majesty would instantly shut them all up, yet he would not answer for him. The order was repealed. You may imagine how glad I shall be to get home after such a continual accumulation of materials, without time to digest and apply. I have, besides four books sent home by Murchison, nine others and a half entirely full of geological sections, notes, &c. It is very encouraging to perceive by my letters how much more every year the subject is taking hold of the public mind. My own opinion of its future capabilities has been very much raised by my tour in Sicily.

Believe me, your affectionate brother,

CHARLES LYELL.

To RODERICK J. MURCHISON, ESQ.

Rome: January 22, 1829.

My dear Murchison,—Monte Mario turned out, as I expected, my Sicilian formation, and not sub-Appenine. Tivoli and its cascades gained in beauty by the late heavy rains, but I had my usual good fortune in a bright sunny day to view them, and study the grand section of travertin, 500 feet perpendicular, there displayed. That this was formed in an ancient small lake, and not, as some have dreamt, in the course of the Anio, I have full proof. Some of the pisolitic and oolitic

travertin there throws much light on some of my Sicilian beds, as does still more Omalius d'Halloy's older travertin of the plain near Tartaret. That variety of travertin which they call 'tartaroso' is precisely our great tubular travertin near La Serre, so like, that if they changed places, the migration would never be detected. This contains, with the plants (but very rarely indeed), helices. The older travertin, of which a great part of Rome is built, contains no organic remains. It affords me some delightful Sicilian analogies, but I hardly think it does any to Central France, at least I must see our specimens again before I answer for it. It is entirely different from the other travertin, or that which resembles the indusial. If I were to return to Auvergne, the indusial travertin and the other, and probably some of the rest of the compact calcareous limestones, would now appear as volcanic to my eyes as the augitic sands. It seems to me an immense oversight in all who have passed through Tuscany, the Campagna Romana, and Sicily, to have brought hot springs so little into play in their systems. There is in the Campagna di Roma a beautiful chain of alluvial phenomena, which, but for Moses and his penal deluge, would have thrown more light than any part of Europe on the modern ages of the earth's history, and they tend to confirm I think the Boulade[1] case as viewed by us. I have got news again of the Viterbo bones, and envy the first *Sedgwick* who gets at them. They are elephant and co., and are in an alluvium *overlaid* by *prismatic* lava of one of the extinct Tuscan volcanoes! The elephant and rhinoceros in alluvium about Rome, which is geologically thousands of years younger than 'crag.' This alluvium is younger than most, if not all of the extinct volcanoes of that district, as appears beyond a doubt both by its contents and its relation to the present valleys, and to the alluvial volcanic tufas. Ricasoli, who travelled much with Brocchi, is a capital worker, and if the poor devil was in a more favourable situation would do much. Babbage or Herschel would be diverted to hear that Scarpellini could not lionise the

[1] Boulade bone-bed. See paper by Lyell and Murchison on Excavation of Valleys, illustrated by the volcanic rocks of Central France.—*Edinburgh Philosophical Journal*, 1829.

museum to me this morning, as a Cardinal had requested him to assist at the solemn benediction and christening of a great new *bell*, to be put up to-morrow in St. Mary's. But Ricasoli went with me to the museum, and the varieties of travertin there are most instructive. Lord Northampton had formerly presented Padre Ricca with a handsome set of Scotch minerals, and his letter of introduction procured me duplicates (very fine) of Sienese fossil shells from Ricca. Then I hunted up the widow of the late porter of the museum, and for a dollar and a half got forty species more. Then last, not least, Ricca introduced me to an active intelligent young Belgian, who has been sent by the King of the Netherlands to collect in natural history, by name Canraine. I found him very anxious to learn something of geology. He knew where the sections were, and went with me. I taught him the geology, and he gave me a list of the shells found in said localities. By degrees he became so interested with the new views, that he begged me to stay a day more, which I will do, for I shall get more fossils, and he has already undertaken that the University of Leyden shall send to our Geological Society *a complete set of Sienese duplicates*, and in return receive English fossils. We may hope for this next summer, and expect at least 500 or 600 species. The result is that here the *Sabbia giallonale* is not one formation with the blue marl (which from here to south of Sicily is called by all, chalk, creta, and when they talk French, *la craie*). The sand has an immensely nearer relation to the Mediterranean than the inferior formation, and comes very close, if not quite, to any Sicilian fossil beds. Now I told Guidotti that he ought to find something of this at Parma, where the whole thickness exceeds 3,000 feet, which could not be the work of a day, even in a geological calendar, but he protested it was not so. However, I have now stirred him up with a letter, and as he told me he should collect this winter quite with new eyes after my cramming, I shall look with much curiosity for his answer. Between the yellow sand here, which is 300 to 400 feet, and the inferior blue marl, which is thousands of feet deep, is a beautiful formation, consisting of alternations of fluviatile and marine beds. If the tertiaries from the north of Italy

to Cape Passaro shall ultimately correspond to my present view of them, they will I think establish for ever the elevation theory; but I am the more afraid of their certainty, in proportion as they suit, so beautifully, the system I anticipated. But when all my specimens are examined, when the rest are collected by my agents and Lord Northampton at Palermo, when Costa sends me the results promised of his Calabrian expedition next summer; when I get from Ricasoli the Roman, and from Canraine the Tuscan list, and from Guidotti a fresh examination of sub-Alpine, &c., then I will make all necessary modifications; for in the main I am sure I cannot now be shaken, and Ischia and Etna form one extreme of the series, and perhaps Parma, &c., the other; but more when we meet. In the meantime do not take off the freshness of my revolutionary prospects by too early disclosures.

Ever yours,

CHARLES LYELL.

To RODERICK J. MURCHISON, ESQ.

Geneva: February 5, 1829.

My dear Murchison,—In my last I mentioned my Siena operations, which ended in my bringing away a respectable box of fossils, but unluckily we cannot at present get any collector there to work for money. At Genoa I found Viviani, gentlemanlike and intelligent, pretends not to geology, but would soon make any one like natural history, and we owe to him Paretto and Sasso. The former was, unluckily for me, still in France; the latter, a young physician, has written a very fair memoir on the basin of Albenga, west of Savona and Genoa, and of which our Savona blue marl was an outskirt, and he has given a list of 200 shells. Some Brongniart saw, and the rest Bronn, a German, corrected. I found that Paretto has lately published an article on the Cadibona coalfield, which, as well as Sasso's, I purchased after a toilsome hunt in the stalls. Paretto leaves little for us to do, but as you will soon read it, I say no more; but the way he has hit off the Siena basin in a note, convinces me he will make head soon of all the Italians. He is only twenty-eight, independent, and full of zeal and talent.

I found at a Pharmacien's a decayed jaw of Cadibona, which I strongly suspect was a stag's. It was not worth accepting, nor would it have travelled, but I found a noble piece in the Museum, which they seem to have been hardly conscious of themselves, for Paretto positively overlooked it! One molar and two canine teeth of an animal about the cut of a tiger, all fixed in the jaw, decidedly a large carnivorous beast. I got Viviani to order it from under the glass to his own house, and there to let me draw it; and when he saw how badly I got on, he took his *camera lucida*, and with enviable rapidity and faithfulness finished a drawing of it of natural size, distinguishing also between the coal and bony parts.

Viviani has some splendid views, founded on a multitude of facts, as to the distribution of plants in the Mediterranean islands, for botany is his *forte*. I struck up a geological theory to account for them, which, although it shook his nerves, pleased him so much, that he gave me two of his works on botany. I pushed on, per courier, through deep snow and hard frost to Turin, and was there only part of the day, closeted with Borelli nearly all the time. He showed me his list of the shells which La Marmora got this year in Sicily. Some species which I had not, but the whole not numerous. I was delighted to find that the conclusions from the list as named by Borelli were the same I came to from Costa's catalogue. Over the latter, B. looked with amazing interest, and after cutting up his names, &c., said, 'But still you need not be afraid to reason on them as a geologist!' He was astounded at the result, and said, 'I begin to think the day *may* come when the retiring of the ocean will be doubted and disputed by many.' He has at last been curious to know what difference there would be in the inferences from the sub-Apennine north of Tuscany, and at last proposed that when I published my Sicilian lists I should add one from him. I told him I should have craved this before, but did not, because I knew his intention to publish such a list. He looked over Sasso's Albenga list, and after swearing it was a string of blunders, surprised me by saying, 'Yet, after all, I have no doubt, from some Albenga shells which I have, that your conclusions from Sasso's list were quite just, and

though he has mistaken genera, &c. &c., yet there are not more than ten blunders in 200 which could mislead a geologist, which would not be to him serious in the main.'

There was nothing but snow and biting frost between Turin and Chambery in diligence. Thence to-day I came in a char, and did some interesting geology. A beautiful tertiary basin of green sand, facsimile in mineralogical appearance to Superga, and also with some blue marl surrounded by those marble-like, amorphous, dolomitic, or calcareous rocks like Nice. The pebbles are not Serpentine in this instance, but chloritic schist and green hornblende schist. A conglomeration just like Superga tops all. I shall get up this concern here. This green sand and sandstone, as well as the superincumbent conglomerate, is provincially termed 'molasse.'

February 6.—I have just had this morning a famous geologico-botanical discussion with Professor De Candolle, and am almost certain that my spick-and-span new theory on this subject will hold water.

Always affectionately yours,

CHARLES LYELL.

To HIS FATHER.

Geneva : February 7, 1829.

My dear Father,—I arrived here on the evening of the 5th. The hills between Genoa and Alexandria were covered with deep snow and ice, and the frost intense. I got a place with the courier, so that it was soon over, but though I wrote a week before to Turin, all the places per courier for Mont Cenis were forestalled for five weeks. The diligence performed twenty-four miles on sledges, and ought to have done much more. Two days before, an avalanche stopped the diligence for twenty-four hours, just at the very coldest part: they had just cut through it when we arrived. Fifty stout workmen were employed. The manner in which the road is kept up is admirable, and when one sees the Alps in winter, it is wonderful to think that one can pass in sixteen hours. I was not a little relieved when I got to Chambery, without a frozen toe or finger, for the cold is unusual this year. On

descending to Alexandria, the chariot fell into some deep frozen ruts, and shook me and the courier out of our sleep. The poor old gentleman believed it was another earthquake, for he had been bruised by the shock when *en voiture* on the same mountains. The gloom still sensible in the minds of the Genoese in consequence of the earthquake is very remarkable—it is now six months since. Almost every house was rent, the inn where I was had sixteen fissures in the walls. For eight days every vessel and boat in the port, every square, and all the suburbs, were filled day and night by the inhabitants. All the troops were insufficient to act as a police, as almost every door was left open, as each slight shock made them rush out. One more like the first would have brought half the town down. I have profited far more in my homeward tour, rapid as it has been, than I had the least idea I should have done. At Siena I got a handsome present of fossil shells from the excellent Padre Ricca, to whom Lord Northampton had given me a letter. I also struck up an alliance with M. Canraine, a naturalist now in Tuscany, charged with a mission by the King of the Netherlands on scientific subjects, collecting, &c. His letters will give me much information which I yet want on the tertiary basin there. My facts on these recent beds in different parts are beginning to point to curious results. At Genoa, besides several geologists, I found Viviani, the botanical professor, a very superior man. His generalisations on the distribution of plants in the isles of the Mediterranean lead to splendid theories. I fitted them to my new system of geology for Sicily and Southern Italy, by which he was pleased, and gave me two of his botanical works.

I was anxious to come here, instead of by Lyons, to get some ideas from De Candolle on my new geologico-botanical theory. He did not of course remember me, but when he heard my name, he asked after you, and said I should take *une petite brochure*, as a souvenir from him. He is in full force, and has been most useful to me, having given me what cannot be bought, his splendid essay on Geographical Botany, the most beautiful generalisation of a multitude of facts which I think was ever produced in natural history. I am now convinced that geology is destined to throw upon this

curious branch of inquiry, and to receive from it in return, much light, and by their mutual aid we shall very soon solve the grand problem, whether the various living organic species came into being gradually and singly in insulated spots, or centres of creation, or in various places at once, and all at the same time. The latter cannot, I am already persuaded, be maintained. Viviani was puzzled to account for Sicily having so much less than its share of *peculiar* indigenous species, but this should be, for I can show that three-fourths of this isle were covered by the sea down to a period when nine-tenths of the present species of shells and corals (and by inference of plants) were already in existence. Such an isle like Monte Nuovo has been obliged to borrow clothes from its neighbour, having scarcely had time to furnish any yet for its own nakedness. It has not yet seen out a tenth, perhaps not a twentieth part of a revolution in organic life. Give it the antiquity of the high granitic mountains of Corsica, and it will also boast its indigenous unique plants, unknown elsewhere either in the Mediterranean or other part of the globe.

Necker, grandson of Saussure, is a good geologist here, young and independent, just returned from a tour in Dalmatia. With him I have already mastered much of the geology of these parts. We have defied the snow in our excursions. I start to-morrow, and shall be in Paris in four days.

With love to all, believe me, your affectionate son,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

Paris: February 19, 1829.

My dear Sir,—Deshayes, now the strongest fossil conchologist in Europe, has lost so seriously by his fine work on the shells of the Paris basin, that he is not only obliged to stop, so miserably is it encouraged, but his circumstances are injured for a time by it. I have bought a copy (seventy francs), to help him, and as I find he has amassed in his researches for new things a multitude of fine duplicates, I trust through Prévost to negotiate a purchase for you. The

grand thing will be to get the names of perhaps 100 *genera* from such a man, who is acknowledged to be the Cuvier of tertiary shells, no mean acquirement now that they amount in *his museum*, including those living in the Mediterranean and the Channel, to above 3,000 species. His drawings of microscopic shells of the Paris basin are most curious. Such incredible forms of multilocular shells, and some so elegant. God knows whether the work will ever come to these. It is one-third finished.

February 20.—Just heard a good lecture of Prévost's to a numerous class. It was on diluvium and caves, a good logical refutation of the diluvian humbug. The news of the day is that a Dr. —— has just read a memoir at the Institute on a new small tapir, and produced the head and jaws. It inhabits the mountains of Upper India, and they swear that the species is not distinguishable hardly from one of the Montmartre Paleotheriums. In return I announced Mary Anning's[2] new Pterodactyle of Lyme. How grand your museum will look when, under every bone of which the ornithologists could make nothing, you write Pterodactylus Dorsetianus and Tilgetanus! Prévost has a beautiful large mâchoire of an Anoplotherium, which he showed me imbedded in gypsum, intended as a present for you, and if we succeed in getting the shells, it is to go with them. He observed, 'This will be better, for it will cut a mighty figure among the cockles; but if it is thrown into Cuvier's large caisse it will be drowned.' I have no fear of getting the shells, and if it answer expectations I shall be able to enlarge the commission in future, should you incline to be sumptuous. In the meantime prepare to disburse 100 francs, which I shall pay Deshayes before I leave Paris, which I suppose will be in two days, for town. Young Brongniart protested at breakfast on Sunday at his father's, before a large party of *savans*, that you knew more of fossil plants than any man in England. I could have told him that a certain Mr. Stokes[3] had recently accumulated a quantity of

[2] Miss Mary Anning, of Lyme Regis, who was zealous in excavating the fossils of that region.

[3] Charles Stokes, b. 1783, d. 1853, a respected member of the Stock Exchange, full of vast research in the Natural History Sciences, and remarkable for literary and antiquarian, musical and artistic, knowledge.

fossil and recent woods, plants, &c., which with no small study, and that too aided by *Brown*,[4] had placed him in a situation to become the critic of Adolph B. himself, which moreover he will be, as I learn—but I kept this to myself, as it will be time enough when he learns it.

Ever truly yours,

CHARLES LYELL.

To HIS SISTER.

Paris: February 23, 1829.

My dear Marianne,—I was glad to find your letter here on my arrival seven days ago, after a fagging journey of four days and four nights from Geneva, having only had six hours' rest at Dijon. Sledges for forty miles over deep snow on the Jura, and ice the rest of the way, so we were continually summoned by the conductor to turn out of the warm inside, while the horses tried to pull the diligence up. Notwithstanding this, the company of a clever and lively French officer in the interior, and some good memoirs given me at Geneva, rendered the journey not without some amusement. The difficulty of keeping warm was great enough. Here I found a better climate. The very evening of my arrival I caught Prévost just going to give a lecture, and met there other geologists, who took me next morning to a lecture at the École des Mines, and thus I got thrown in a few hours into the heat of the battle, which is carried on with vigour, notwithstanding the complaints of the *savans* that the public will think of nothing but politics and romances, and their evident fear that we shall soon distance them in England in this branch.

I have learnt very much from various old and new acquaintances, and although they have pumped me somewhat unmercifully, I am sure I have reaped most from the exchange. Some of them have come by most opposite routes to exactly the same conclusions as myself, and we have

[4] Robert Brown, b. 1773, d. 1858, President of the Linnæan Society, accompanied Captain Flinders as naturalist in the 'Investigator' round the shores of Australia in 1802, &c. An indefatigable and profound botanist. Named by Humboldt *Botanicorum Princeps*. He inherited Sir Joseph Banks's herbarium, which is now in the British Museum.

mutually felt confirmed in our views, although the new opinions must bring about an amazing overthrow in the systems which we were carefully taught ten years ago. I have established a regular correspondence with Deshayes, now by far the principal conchologist in fossils, and he is to name all my fossil shells from Sicily. I have also been getting the necessary works, and many are German. How glad I am to hear you are determined to persevere in it: do not be frightened by the barbarous aspect of it. I would give a hundred pounds if I knew it decently, indeed it would soon be worth that to any author who writes on natural history. I shall work at it hard before a year passes away. Cuvier is in great force, and gave a famous soirée the other day. He has been chosen by the ministers to defend their municipal law in the tribune: two months of his time will thus be lost to science. He talked to me of the Catholic question, our corporation rights, &c., and not a word could I get on natural history. Yet this year he has come out with four volumes on fish, and eight more will appear in two years. He has received between 2,000*l.* and 2,200*l.* for it, whereas no other person in Paris could persuade a librarian to publish one volume for nothing. He is also publishing another edition of his 'Règne Animal,' and other things. He has been very obliging to me, for on my applying for casts of animals for Mantell, who has been begging in vain for a long time, he gave me an order for whatever I liked, so I have sent off from the museum a huge box with casts of *every* thing. I got into Cuvier's sanctum sanctorum yesterday, and it is truly characteristic of the man. In every part it displays that extraordinary power of methodising which is the grand secret of the prodigious feats which he performs annually without appearing to give himself the least trouble. But before I introduce you to this study, I should tell you that there is first the museum of natural history opposite his house, and admirably arranged by himself, then the anatomy museum connected with his dwelling. In the latter is a library disposed in a suite of rooms, each containing works on one subject. There is one where there are all the works on ornithology, in another room all on ichthyology, in another osteology, in another *law* books! &c. &c. When he is

engaged in such works as require continual reference to a variety of authors, he has a stove shifted into one of these rooms, in which everything on that subject is systematically arranged, so that in the same work he often takes the round of many apartments. But the ordinary studio contains no book-shelves. It is a longish room, comfortably furnished, lighted from above, and furnished with eleven desks to stand to, and two low tables, like a public office for so many clerks. But all is for the one man, who multiplies himself as author, and admitting no one into this room, moves as he finds necessary, or as fancy inclines him, from one occupation to another. Each desk is furnished with a complete establishment of inkstand, pens, &c., pins to pin MSS. together, the works immediately in reading and the MS. in hand, and on shelves behind all the MSS. of the same work. There is a separate bell to several desks. The low tables are to sit to when he is tired. The collaborateurs are not numerous, but always chosen well. They save him every mechanical labour, find references, &c., are rarely admitted to the study, receive orders, and speak not.

Brongniart, who in imitation of Cuvier has many clerks and collaborateurs, is known to lose more time in organising this auxiliary force than he gains by their work, but this is never the case with Cuvier. When I went to get Mantell's casts, I found that the man who made moulds, and the *painter* of them, had distinct apartments, so that there was no confusion, and the despatch with which all was executed was admirable. It cost Cuvier a word only.

Murchison writes me word that Mary Anning has immortalised herself anew by finding at Lyme a skeleton of one of those flying lizards (pterodactyles), of which two only were known of distinct species, and none before in England. Buckland has written a paper, and there has been much merriment at the Society about the Dragon of Wantley having devoured all the birds, for they now declare that the Stonesfield *soi-disant* birds' bones all belonged to this winged reptile. Murchison and his wife have been with Mrs. Somerville, spending a week at Christ Church, and he laments that Buckland voted for the anti-Catholic petition, which conduct, he says, Mrs. Buckland assured him was to be attributed to his Sicilian expe-

dition, and he trusts my journey has not made me intolerant. Certainly, if any country could make me abhor Catholicism in its worst form, it is that island, and you may have gathered this from my letters; but I confess I think it no small want of logic to confound the emancipation question with the state of Spain and Sicily. Besides, if fanaticism were to be the measure of disability, I fancy that no small part of our sectarians and even more orthodox saints would be entitled to their share. I wish you were in the way of getting on in conchology: the extent and beauty of these objects is truly wonderful, and the results are becoming most important every day. It is the ordinary, or, as Champollion says, the demotic character in which Nature has been pleased to write all her most curious documents. We will try to get a more active exchange with Mrs. Buckland of insects for shells. Murchison tells me that seventy more fossil insects have been sent off for us from Aix.

With love to all, your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

London: February 26, 1829.

My dear Caroline,—I have not announced my arrival except to Murchison, and shall appear at the Royal Society this evening for the first time. I find the Geological Society and Sedgwick, the new President, have persuaded Murchison to become Home Secretary for a year, as they dubbed me Foreign Secretary, which I trust will give me very little trouble. Sedgwick quite astonished them, it seems, in the chair at the general meeting, which was very full. Among innumerable good hits, when proposing the toast of the Astronomical Society, and Herschel, their president, he said, alluding to H.'s intended marriage (for he is just about to marry the daughter of a Scotch clergyman), 'May the house of Herschel be perpetuated, and, like the Cassinis, be illustrious astronomers for three generations. May all the constellations wait upon him; may Virgo go before, and Gemini follow after.' Poor H., notwithstanding his confusion, got up after the roar of laughter had continued for three minutes,

and made a famous speech. You say you should like to have *chased the Edusas* in Sicily, as you have only two tattered ones. Pray explain, Mrs. Conservatrice del Museo, what has become of the splendid specimens I sent last year, and let me have your *Artaxerxes*.

Lieutenant Graves has sent a letter, saying that two boxes are in town for me from him, one all skins of birds from Straits of Magellan, and one geological. All the Auvergne and French boxes necessary for the joint paper of Murchison and me are arrived safe. I have already made progress in working up materials here, and in Paris I did much. Deshayes is positively to give me tables of more than 2,000 species of tertiary shells, from which I will build up a system on data never before obtained, by comparing the contents of the present with more ancient seas, and the latter with each other. He is to name all my Sicilian shells.

With love to all, believe me, your affectionate brother,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

April, 1829.

Dear Mantell,—A splendid meeting last night. Sedgwick in the chair. Conybeare's paper on Valley of Thames, directed against Messrs. Lyell and Murchison's former paper, was read in part. Buckland present to defend the 'Diluvialists,' as Conybeare styles his sect, and us he terms 'Fluvialists.' Greenough assisted us by making an ultra speech on the importance of modern causes. No river, he said, within times of history, has deepened its channel one foot! It was great fun, for he said, 'Our opponents say—"Give us time, and we will work wonders." So said the wolf in the fable to the lamb: "Why do you disturb the water?" "I do not; you are further up the stream than I." "But your father did." "He never was here." "Then your grandfather did, so I will murder you. Give me *time*, and I will murder you." So say the Fluvialists!' Roars of laughter, in which Greenough joined against himself. What a choice simile! Murchison and I fought stoutly, and Buckland was very piano. Conybeare's memoir is not strong by any means.

He admits three deluges before the Noachian! and Buckland adds God knows how many *catastrophes* besides, so we have driven them out of the Mosaic record fairly.

Yours very truly,
CHARLES LYELL.

To GIDEON MANTELL, ESQ.

London: June 7, 1829.

My dear Mantell,—The last discharge of Conybeare's artillery, served by the great Oxford engineer against the Fluvialists, as they are pleased to term us, drew upon them on Friday a sharp volley of musketry from all sides, and such a broadside at the finale from Sedgwick, as was enough to sink the 'Reliquiæ Diluvianæ' for ever, and make the second volume shy of venturing out to sea. After the memoir on the impotence of all the rivers which feed the 'main river of an isle,' and the sluggishness of Father Thames himself, 'scarce able to move a pin's head,' a notice by Cully, land-surveyor, was read on the prodigious force of a Cheviot stream, 'the College,' which has swept away a bridge, and annually buries large tracts under gravel. Buckland then jumped up, like a counsel, said Fitton to me, *who had come down special.*

After his reiteration of Conybeare's arguments, Fitton made a somewhat laboured speech. I followed, and then Sedgwick, who decided on four *or more* deluges, and said the simultaneousness was disproved for ever, &c., and declared that on the nature of such floods we should at present 'doubt, and not dogmatise.' A good meeting.

I am to start for Scotland June 20, and shall be there two months.

Ever truly yours,
CHARLES LYELL.

To DR. FLEMING.

Temple: June 10, 1829.

My dear Sir,—I was glad to hear from you, and can assure you that I have been so busy since my return that I had no correspondence with any one except on business, though

I would gladly have written to you at any time, if I had not been always hoping to have sent you a paper, *we think a floorer,* of Buckland's diluvial question. You will get a separate copy, and I wish it may be an antidote to a sharp attack which I hear Conybeare and Buckland have levelled at you, in the same number, about 'climate,' &c. Buckland was so amazingly annoyed at my having had such an anti-diluvialist paper read, that he got Conybeare to write a controversial essay on the Valley of the Thames, in which he drew a comparison between the theory of the Fluvialists, as he terms us, and the Diluvialists, as (God be praised) they call themselves.

Of course, in defining the Fluvialists, they (for Buckland wrote half the memoir) took care to build up their man of straw, and triumphantly knocked him down again. But in the animated discussion which followed the reading of the first half of the essay, at the Geological Society, we made no small impression on them. And when, last Friday, the remainder came on, we had a hot rencounter. Buckland came up on purpose again, and made a leading speech. But after we had exposed him, and even Greenough, his only staunch supporter, had given in in many points, Sedgwick, now president, closed the debate with a terribly anti-diluvialist declaration. For he has at last come round, and is as decided as you are. But you must know that Buckland now, and Conybeare, distinctly admit three universal deluges, and many catastrophes, as they call them, besides! But more of this when we meet.

I hope to be at Kinnordy the first week in June, and to see you then soon after. Your discovery of the fish may probably confirm the opinions given by Sedgwick and Murchison on our district, as they compared the older sandstone of the Sidlaw to the Caithness sandstone containing fish. One reason why I did not write was, to tell the honest truth, that I have seen so much, and so greatly altered my views, that I know not where to begin, and nothing but a good three days' confab, *tête-à-tête,* will suffice. I shall see, in my way up, much of the geology of the east of England, and perhaps, in my way down, of the west.

I am preparing a general work on the younger epochs of the earth's history, which I hope to be out with next spring.

I begin with Sicily, which has almost entirely risen from the sea, to the height of nearly 4,000 feet, since all the present animals existed in the Mediterranean!

Ever most sincerely yours,

CHARLES LYELL.

To DR. FLEMING.

Kinnordy: October 11, 1829.

Dear Dr. Fleming,—When I showed your vegetable impressions to the quarrymen of Kirriemuir, many declared that a great number exactly similar were got this year from a quarry called Bron-head or Bren-head at Locheye, between Dundee and Auchterhouse, which is now working on the property, I believe, of Mr. Clayhills. I have written to Lindsay Carnegie of Kinblethmont, who of all our lairds promises fairest to be a keen geologist, to go to his neighbour Mr. Muir, and take instructions. In the meantime, Carnegie has written to me to say that he has offered premiums for fossils in his own pavement quarries. I shall leave with Blackadder, for a time, the specimens of scales and plants, to show about to the men. I am glad to find lately that pavement stone is worked successfully at Ferne, on the Grampian side of the trough of Strathmore, between which and Arbroath the pavement and a powerful conglomerate are each thrice repeated; each twice with a southerly, and once with a northerly, dip. I have just received a famous letter from Murchison. He and Sedgwick have worked very hard in the basin of the Danube, Hungary, Styria, &c. Sedgwick was astonished at finding what I had satisfied myself of everywhere, that in the more recent tertiary groups, great masses of rocks, like the different members of our secondaries, are to be found.

They call the grand formation in which they have been working, sub-Apennine. Vienna falls into it. I suspect it is a shade older, as the sub-Apennines are several shades older than the Sicilian tertiaries. They have discovered an immensely thick conglomerate, 500 feet compact marble-like limestone, a great thickness of oolite, not distinguishable from Bath oolite, an upper red sand and conglomerate,

&c. &c., all members of that group zoologically sub-Apennine. This is glorious news for me. They tell me to hold my tongue till our next session. It chimes in well with making old red transition mountain limestone and coal, and as much more as we can, *one epoch*, for when Nature sets about building in one place, she makes a great batch there, and old Werner's universal envelope was, as my correspondent says of some of Brongniart's extension of the Parisian type, a humbug. All the freshwater, marine, and other groups of the Paris basin are one epoch, at the farthest not more separated than upper and lower chalk. They have also found a great gypsum and salt formation in the Alps, over lias fossils, which charms me.

Mrs. Murchison's letter contains the painful news that poor Conybeare has been thrown out of his gig, and received a dreadful concussion of the brain. When the accounts came away, he was delirious; no hopes entertained of his life. A ride to-morrow with Blackadder, and an examination of the whole section of the Noran river, will be a finale to my outdoor geology for 1829.

Very truly yours,

CHARLES LYELL.

To DR. FLEMING.

9 Crown Office Row, Temple: October 31, 1829.

Dear Dr. Fleming,—Conybeare, after being fourteen days insensible, not even recognising his wife, is recovering; and there are hopes that he will get quite over it, but will be stopped from working for a time, of course. 'The father of stercoraceous chemistry,' as Buckland called himself in a letter, has strengthened his theory, but had to retract also on one or two points.

Sedgwick and Murchison are just returned, the former full of magnificent views. Throws overboard all the diluvian hypothesis; is vexed he ever lost time about such a complete humbug; says he lost two years by having also started a Wernerian. He says primary rocks are not primary, but, as Hutton supposed, some igneous, some altered secondary. Mica schist in Alps lies *over* organic remains. *No rock* in

the Alps older than *lias!* Much of Buckland's dashing paper on Alps wrong. A formation (marine) found at foot of Alps, between Danube and Rhine, thicker than all the English secondaries united. Munich is in it. Its age probably between chalk and our oldest tertiaries. I have this moment received a note from C. Prévost by Murchison. He has heard with delight and surprise of their Alpine novelties, and alluding to them and other recent discoveries, he says, 'Comme nous allons rire de nos vieilles idées! Comme nous allons nous moquer de nous-mêmes!' At the same time he says, 'If in your book you are too hard on us on this side the Channel, we will throw at you some of old Brongniart's "metric and peponary blocks," which float in that general and universal diluvium, and have been there depuis le grand jour qui a separé, d'une manière si tranchée, les temps ante-des-temps Post-Diluviens.'

In some sandstone sent from Glammis I find some white stains with a bluish tinge, having clearly some analogy to your fish scales, but much decomposed.

Remember me to Dr. Fleming, and believe me very truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

November 24, 1829.

My dear Sir,—My friend G. Eyre, a barrister who is attending law lectures at the London University, happened to say this morning, that when Lardner spoke of the vacant Chair of Mineralogy and Geology in his introductory lecture, a brother student had mentioned to him that there had been a report of *my* being thought of for it. I ought therefore to tell you that I have always felt it, and do now, to be out of the question; and if the council wish to fill it up, you must consider me quite out of the way, both in justice to the Institution and other candidates.

I have received this morning a letter from young Allen, full of *mineralogical* zeal for an Icelandic tour. I find that we must go the latter end of April, in which case I should

only be able to get out Vol. I., which I believe I shall do, for I should like to make sure of Hecla.

I have not waited till we meet, because I did not feel comfortable under the idea that I had let you go away the other day with a notion that I only wanted to be *pressed* a little. I should like for your sake, and for the science, to see a good man in, but it ought, I believe, to be a man of fortune, who did not hope to pay his travelling expenses by what he made. In the meantime I am quite sure, whoever may be the candidates, that you do good by deferring an election, because every lecturer who has not a good class rather does harm to the Institution, and one cannot expect it in geology yet.

Believe me, ever most truly yours,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

Temple: Saturday, December 5, 1829.

Dear Mantell,—We were all disappointed at your not being here yesterday, for Murchison told us you were to have been here. Sedgwick and his wind-up on the Alps went off splendidly in a full meeting. You and the iguanodon treated by Buckland with due honours, when exhibiting some great bones of a little toe from Purbeck. He greatly amazed my friend Sir T. Phillips by his humour about the size of the said giant, compared to the small *genteel* lizards of our days.

I am bound hand and foot. In the press on Monday next with my work, which Murray is going to publish—2 vols. The title—'Principles of Geology; being an Attempt to Explain the Former Changes of the Earth's Surface by Reference to Causes now in Operation.' The first volume will be quite finished by the end of the month. The second is in a manner written, but will require great recasting. I start for *Iceland* by the end of April, so time is precious. You must let us see you here. What particular scheme have you at present in geology? Your list of shells will be grand things.

Very truly yours,

CHARLES LYELL.

CHAPTER XI.

FEBRUARY–AUGUST, 1830.

DR. FLEMING'S REMARKS ON CONYBEARE—DETERMINATION NOT TO ENTER INTO CONTROVERSY—OPENING OF THE ATHENÆUM CLUB—MILMAN'S 'HISTORY OF THE JEWS'—PROPOSED TRIP TO THE CRIMEA—LETTERS TO POULETT SCROPE ON THE 'PRINCIPLES'—LEAVES ENGLAND WITH CAPTAIN COOKE FOR THE PYRENEES—EXCURSION INTO CATALONIA.

[The first volume of 'The Principles of Geology' was published in 1830, and after having relinquished sundry plans of going to Iceland, the Crimea, and Black Sea, &c., he finally settled on accompanying Captain Cooke, R.N., in the summer of this year, to explore the geology of the south of France and the Pyrenees, and from thence he went alone to Catalonia, to examine the volcanic region round Olot.]

CORRESPONDENCE.

To DR. FLEMING.

Temple: February 3, 1830.

Dear Dr. Fleming,—My eyes have been at times somewhat weakened by the small print of my notes, and this prevents my being so good a correspondent as I would otherwise most willingly be; but I am in great spirits to find that by help of a good amanuensis my eyes hold out so well, as they have certainly gained strength for many years, and were never so equal to the work since I first went to school, as now.

The answer to Conybeare is severe enough, and both instructive and amusing; and to those who, like true Englishmen, love to see a good fight, it has afforded more sport than any round fought for many a year. Mantell, whom I visited at Christmas, was mightily delighted with it, but thought you might have spared Cuvier, who, by-the-bye, had

lately sent him a magnificent present of fossil casts. Daubeny, who has just come up from Oxford, told me that the Oxonians made just the same remark, congratulating Buckland that Monsieur le Baron had been put on the pillory with him, and had come off with perhaps the greatest expressions of contempt. I will fairly own that this struck me on first reading, and I was the more surprised when I found that you meant to call him as your principal witness in your cause. As he and Lamarck have their worshippers, as well as Conybeare, it would be good policy to be more courteous towards them, until they provoke you as he did.

I sincerely hope you will keep in well with some party, but if you go on much longer, with an anti-Bucklandite, anti-Mackayite, anti-Lamarckian warfare, I begin to fear the odds; and as Sedgwick prophesies that the Professor's book will never lose the title of 'idola specus,' so I dread your retaining a name which I heard applied to you yesterday by a zoologist, 'the Zoological Ishmael.' The 'idola specus' is allowed to be as clever a hit as ever was given, and the Cambridge Professor stood up manfully for you, when others were saying you were too savage, by saying that a man had a right to say hard things in a controversy. But your indiscriminate attacks are what I allude to as alone injurious. To show that you can strike home may save you from many an adversary, but I am sure many new ones will now be called forth.

As a staunch advocate for absolute uniformity in the order of Nature, I have tried in all my travels to persuade myself that the evidence was inconclusive, but in vain. I am more confirmed than ever, and shall labour to account for vicissitudes of climate, not to dispute them. I have only corrected the press to page 80, and get on slowly, but with satisfaction to myself. How much more difficult it is to write for general readers than for the scientific world, yet half our *savans* think that to write *popularly* would be a condescension to which they might bend if they would.

I daresay I shall not keep my resolution, but I will try to do it firmly, that when my book is attacked—as it will be a greater hornets' nest than a small sally of yours in Jamieson can be, however pointedly against popular doctrines—I

will not go to the expense of time in pamphleteering. I shall work steadily on at Vol. II., and afterwards, if the work succeeds, at edition 2, and I have sworn to myself that I will not go to the expense of giving time to combat in controversy. It is interminable work. However, in your case, Conybeare, although now recovered, is not preparing, and Buckland, who likes to fight under the shield of Ajax, will not, I suspect, step forth himself. If any smaller people make a noise, you can leave them to do their worst. Buckland is working so hard at organic remains—iguanodons, pterodactyles, and fifty other things—that he may build up a second report in the time he might have spent in fighting you about the old question. To our amusement, at our club last week, when a stranger whom I took there, asked Buckland who Dr. Fleming was (some one had mentioned you), Buckland said, 'Oh! he's a man who ought to have been in Jamieson's chair, or some other in Scotland, &c. &c.; and among other things, you will see in Jamieson's last that he has thrown me into the gutter, as he says!' I cannot help boring you with all this, because I dread half next year being spent in answering the wasps who are preparing their stings, and you can well afford to let them all alone. Sedgwick has his paper on magnesian limestone ready for you. If not sent, I will get it from him. I will look out some organic remains of freshwater, when I have a minute to spare. You talk of not being prolific, but here they think you quite the contrary. If you would not divert your forces from the main point, you will carry it with profit and reputation with one half the labour which these infernal squabbles will involve you in. So ends my epistle. *Qualis ab*, &c.

Believe me, ever most truly yours,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

Temple: February 15, 1830.

Dear Mantell.—I have scarcely used a sheet of my prepared materials since I saw you, and am now engaged in finishing my grand new theory of climate, for which I had

to consult northern travellers, Richardson, Sabine, and others, to read up Humboldt's and Daniel's last theories of meteorology, &c. &c. I will not tell you how, till the book is out—but without help from a comet, or any astronomical change, or any cooling down of the original red-hot nucleus, or any change of inclination of axis or central heat, or volcanic hot vapours and waters and other nostrums, but all easily and naturally. I will give you a receipt for growing tree ferns at the pole, or if it suits me, pines at the equator; walruses under the line, and crocodiles in the arctic circle. And now, as I shall say no more, I am sure you will keep the secret. All these changes are to happen in future again, and iguanodons and their congeners must as assuredly live again in the latitude of Cuckfield as they have done so.

You have always some new discovery to announce. I believe with you it would be difficult to exterminate pentacrinites, yet don't make too sure; for if my new heating and refrigerating theory holds water, I may perhaps give you a cold at the line which may freeze up the pentacrinite. I have been reading at the Admiralty the last despatches of Captain Forster from S. Shetland. They mention fathoming the sea at the borders of the antarctic circle to the depth of 900 fathoms, with a self-registering thermometer. What a glorious depth. Ben Nevis would not make an islet if sunk there, and they found the warmth increase from the surface downwards, as you know in the Spitzbergen seas. Our new hydrographer, Beaufort, is very liberal to all geologists, and you may get what unpublished information you like from the Admiralty, and there is an immense deal there. Yours very truly,

CHARLES LYELL.

To HIS SISTER.

Temple: February 26, 1830.

My dear Eleanor,—I expect p. 128 home from the printer to-night. Every word of advance since you were here has been written, and the matter in great measure collected; so I hope next month, when I fall upon old stores written at Kinnordy, &c., that I shall make great way. I enjoy the work much, as the excitement is great, and I can get such assistance as

perhaps no place but London could afford. I wish you had been in town at the opening of our new club, the Athenæum, which is reckoned the most elegant turn-out of all, and for a fortnight gay soirées were given to the ladies between nine and twelve o'clock, and it still continues to do so every Wednesday, which I hear is to go on for months. It is really worth seeing, and fitted up in a style which I must say would be ridiculous, except for receiving ladies. There has been a great deal of fun about it, verses innumerable. Some of our members grumble at the invasion, and retreated into the library, which was respected at first, but now the women fill it every Wednesday evening, as well as the newspaper room, and seem to me to examine every corner with something of the curiosity with which we should like to pry into a harem. They all say it is too good for bachelors, and makes married men keep away from home, and talk of a ladies' club, &c. As the house was much admired, the number of candidates increased prodigiously. The ballot, which in a smaller house was a nuisance, is now an agreeable muster.

Milman has got into a worse scrape than I suspected by the German latitudinarianism (by way of a laconic term) which he has indulged in in his 'History of the Jews.' Murchison says it is a diversion in my favour, but I trust mine will be thought quite orthodox. At all events the bishops cannot stop my promotion, as they certainly will Milman's. His own parishioners have taken it up, and the once popular preacher is in danger of having his gown torn off. He has challenged the bishops to find *one* opinion in his work not in the notes to *Mant's* Bible, and Lockhart tells me this is true; but the bishops, never having read their own edition of the Bible, are still more annoyed at this discovery. The crime is to have put it forth in a *popular* book.

Yours ever affectionately,

CHARLES LYELL.

To DR. FLEMING.

London: April 18, 1830.

Dear Dr. Fleming,—Sedgwick, when I asked him if he should send his lashing of Ure in his anniversary speech, to

you—said of course there is one for him, for Dr. F. is one of those men who feel not only a love for truth, but an honest indignation against all those who conceal it or tamper with it, or are guilty of any dissimulation. I will add to these, that Mantell is a great admirer on the whole of your last paper, and I give you this to let you see both sides, for I did not in the least exaggerate the storm on the other side. You are one of six or seven writers in this country who combine profound scientific knowledge with a power of presenting it in a popular, powerful, and eloquent style to the public; and if by any circumstances your facility of doing good to the cause is injured by a series of personal altercations, with which I certainly think you have been in a great measure drawn, it is a national loss. Conybeare is giving divinity lectures at Bristol. Buckland, I trust, is going to repose for years under your last fire, as he did under a former one.

The 'dirt bed' which separates Portland from Purbeck rock is now proved to be a peat moss and forest, which grew on an exposed surface of Portland marine oolite. The cycades are all upright, with their roots *in situ*, the tall stems broken and horizontal. The case is more clearly demonstrated than in any submarine forest. What a subsidence *afterwards* to let the green sand and chalk accumulate above!

Believe me, ever most truly yours,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

London: April 23, 1830.

Dear Mantell,—It is nearly the same to pursue a hobby as I am doing, and to be professionally engaged, and so you must excuse bad correspondence; but I assure you I am a mile or two further on by aid of the encouragement held out in your letters, that the production will excite a sensation, which Murray says is the great virtue of a superior author. So much for the market value of commodities. By the way, Sir Philip Egerton said at R. S. last night, that you were the author of the grand catalogue of fossils in the 'Transactions,' which, knowing your other works, he selected as an

extraordinary proof of your being *bien fort*. He brought parts of thirty-one individuals of *Ursus speleus* from German caves, and a great jaw of *Felis spelea*, pronounced by Clift & Co. to be equal in size to a horse! Buckland first pronounced your bone to be that of a deer, and stood out for a long time against its being that of *Goliah*. He declared the bone to be *post-diluvian* and not mineralised, and made light of it, but did not *scratch* it. He is gone down to Lyme, so there is something in the wind—a paper on the new beast perhaps, that fish-like concern which Mary Anning wants to make a grand wonder of, and the Dr. a memoir, as I suppose. His and De la Beche's on Weymouth read last time—good, but some diluvial heresy tacked on, at which I fired a shot. The iguanodon's bones brought by them from Isle of Wight are rolled, ugly, unmeaning pebbles, save one 'sub-quadrangular vertebra,' as Dr. Buckland says, which he declares proves it to be an iguanodon. Even that is imperfect.

Most truly yours,

CHARLES LYELL.

To SIR PHILIP DE MALPAS GREY EGERTON.

9 Crown Office Row, Temple, London: April 26, 1830.

Dear Sir Philip Egerton,—In conversations with Dr. Lee, whom I introduced to you at the Royal Society, I have learnt the extreme practicability of a geological expedition which I feel extremely tempted to undertake this summer; and although my short acquaintance with you would not authorise me to propose that you should take part in it, yet I am sure you will excuse my doing so on the score of being equally attached to geological pursuits.

The tour which Lee made when physician to Count Woronzoff, was from the Sea of Azof, through the Crimea, along the great steppe to the mouths of the Danube, a district full of grand physical features never yet made out, nor visited by a geologist since Pallas. The country is perfectly safe, and with such introductions as we could immediately get, no impediment would be encountered.

The time required not long, and the summer the proper season. The route would be by steam to Hamburg, and then

from Lübeck by steamboat which communicates to Petersburg, where we arrive on the eighth day from London. A day or two would be ample at P., and the diligence is only four days from Petersburg to Moscow, where a splendid city, and the examination of the *tertiary* strata there, would refresh the traveller, and prepare him in a carriage, bought at Moscow, to make direct to Azof, or some place at the north of the Don, where we should be without difficulty on the field of action in a month from our starting from London. Give seven or eight weeks to the Crimea, and the *great steppe*, which latter might be done quick, boxes of shells being shipped easily at Odessa. From Odessa to Vienna, where the carriage is sold at no loss, and from Vienna in eleven days to London, having been absent about four months if you were pressed for time. I will not enter into the numerous geological reasons for selecting that country before any other—the light which the steppe when understood would throw on all the steppes of the Caspian, &c.; the study of the effects of recent earthquakes in Bessarabia, the alluvions of the Don, Dnieper, and Danube, and the Crimea, which is full of various interest. Murchison, who (as I know by experience) is a good campaigner, declares the scheme excellent, but fears your engagements will prevent you from stirring. I should probably start about June 10, but if you are disposed to join, I would wait, if by exertion you could get over your business and go somewhat later. I need not say that to participate in the first making out of an unknown district is the only way to learn to unravel countries for oneself, and that the new facilities now opened have rendered a district accessible in a few weeks which seemed but lately as far removed as the interior of Asia. A courier who can be trusted is easily got at Petersburg. I should make the expedition as strictly geological as our friend Murchison does his, and it is from my confidence that your enthusiasm would equally dispose you to do so, and would carry you through the slight inconveniences, which would after all be of short duration on the tour, which induces me to make this proposition. I shall probably go alone, if you should decline, and I do not wish it to be known, for when I intended to go to Iceland this spring (before I engaged to

supply Murray with a volume on geology), I had two offers of companions, excellent men, but one a mere mineralogist, and the other a sportsman, who would have greatly interfered, and whom I should still, as old friends, have offended by declining. I would enter into many more particulars about this scheme, if I did not feel that it would be going too far before I am aware whether there was any insuperable obstacle to stimulating you to such an enterprise. In regard to health, I have made due inquiries, and you may trust me, an old campaigner, that I should not think of it rashly. It is one of those things that is not open to me every day, and would probably lead to some new and grand views.

Believe me, most truly yours,

CHARLES LYELL.

To HIS SISTER.

Temple: May 11, 1830.

My dear Eleanor,—I have been intending for a month to write and say you were a good-for-nothing gipsy for not sending me a letter till I wrote one myself, as it takes no time to read a letter, though I am really almost too busy to write one. Have you heard from Tom? His things arrived here to-day, by sea from Devonport.

Murray of Simprim asked me to take him to the Geological Club. As luck would have it, he sat next Buckland, with whom he was much delighted, as with a most entertaining lecture delivered by him afterwards, at a full meeting of the Geological Society, on Bones of the Mastodon brought by Basil Hall from N. America, and by Beechey & Co. of Extinct Elephants from Behring's Straits. Also on my Angus Kelpie's feet, which were so much admired, that when I offered the Professor one, he would not accept, saying he should rob the Geological Society, for each differed from the other in something.

Sir George Rose is in great force, and longs to see my book. Pray heaven he may not think me, as he tells me nine-tenths of the German clergy are, 'sold to the devil.' But I assure you I have been so cautious, that two friends tell me I shall *only* offend the ultras. After divers schemes, Iceland, Pyrences, West Indies, the Crimea, Black Sea, &c., I have

definitely settled, positively for the last time, for the Pyrenees. I find I shall be just relieved at the nick of time for them, can get there in eight days, and Captain Cooke, R.N., who is just returned, volunteers to go with me, and be a Spanish guide. Country cheap, no danger, bad fare, bad beds, &c., but that I can stand ; but don't like West Indian fevers, Crimean agues, nor Portuguese robbers, and worse adventures.

Murchison gave me a seat in Lord Darlington's box to see Miss Kemble's Isabella. Did not think it half equal to her Juliet. I hope to have done with my volume by middle of June, and whether it is out then or in October, I begin to feel somewhat indifferent now.

I hope to get my tour over so as to be with you for a time at Kinnordy, but I cannot answer quite for so much.

Believe me, your affectionate brother,

CHARLES LYELL.

To POULETT SCROPE, ESQ.[1]

9 Crown Office Row, Temple: June 14, 1830.

My dear Scrope,—You ought to have received more sheets long ere this : we hope to be out in ten days. As I had nothing to do with your being my reviewer, I am certainly right glad of it; and not the less so, that having withdrawn from the fight some time, you may be a more disinterested umpire than many others who, like you, have committed themselves in print to many opinions. I am sure you may get into Q. R. what will free the science from Moses, for if treated seriously, the party are quite prepared for it. A bishop, Buckland ascertained (we suppose Sumner), gave Ure a dressing in the 'British Critic and Theological Review.' They see at last the mischief and scandal brought on them by Mosaic systems. Férussac has done nothing but believe in the universal ocean up to the chalk period till lately. Prévost has done a little, but is a diluvialist, a rare thing in France. If any one has done much in that way, I have not been able to procure their books. Von Hoff has assisted me most, and you should compliment him for the German plodding perseverance with which he filled two volumes with facts like

[1] Who was about to review the *Principles of Geology*.

tables of statistics; but he helped me not to my scientific views of causes, nor to my arrangement. The division into aqueous and igneous cause is mine, no great matter, and obvious enough. Von Hoff goes on always geographically. For example, he will take as a chapter 'changes in the boundaries of sea and land,' and under this may come alterations by earthquakes as well as by currents, &c. Von Hoff took his 'waste of sea-cliffs,' as far as Britain is concerned, from Stevenson—very meagre. I have done mine from actual observation, principally in coast surveys. My division into destroying and reproductive effects of rivers, tides, currents, &c., is, as far as I know, new—my theory of estuaries being formed is contrary to Bakewell and many others, who think England is growing bigger. In regard to Deltas, many facts are from Von Hoff, but the greater part, not. All the theory of the arrangement of strata in Deltas and stratification, &c., is new, as far as I know, and the importance of spring deposits. Von Hoff thinks all that is now going on, a mere trifle comparatively, though he has done more than any other to disprove it. My views regarding gneiss, mica schist, &c., could not come in Vol. I. Sedgwick found in the centre of Eastern Alps an encrinital limestone alternating with genuine mica schist and the *white stone* of Werner. This made a sensation here at G. S. this session. It was before known to E. de Beaumont. Think of this fact. Whether so made originally or not, it is clear that mica slate owes its stratification to deposition, because the limestone did. *Ergo* after a *cool* sea existed, with zoophytes enjoying the light of heaven, and feeding on some animalcules which lived as now—these rocks were formed no matter how. Graywacke in its most ancient *mineralogical* form is proved to be posterior to *vertebrated* animals at Glaris, and to fuci and some coal plants lately in Ireland. In controverting, just allude to 'having heard something of the Alpine discovery,' because Sedgwick was most unwilling last year to admit such a thing; also hint that my reasons are yet to come, as I say in several passages.

Probably there was a beginning—it is a metaphysical question, worthy a theologian—probably there will be an end. Species, as you say, have begun and ended—but the

analogy is faint and distant. Perhaps it is an analogy, but all I say is, there are, as Hutton said, 'no signs of a beginning, no prospect of an end.' Herschel thought the nebulæ became worlds. Davy said in his last book, 'It is always more probable that the new stars become visible and then invisible, and pre-existed, than that they are created and extinguished. So I think. All I ask is, that at any given period of the past, don't stop inquiry when puzzled by refuge to a 'beginning,' which is all one with 'another state of nature,' as it appears to me. But there is no harm in your attacking me, provided you point out that it is the proof I deny, not the probability of a beginning. Mark, too, my argument, that we are called upon to say in each case, 'Which is now most probable, my ignorance of all possible effects of existing causes,' or that 'the beginning' is the cause of this puzzling phenomenon?

It is not the beginning I look for, but proofs of a *progressive* state of existence in the globe, the probability of which is *proved* by the analogy of changes in organic life. 'Tis an easy come-off to refer gneiss to 'the beginning, chaos,' &c., and put back the finding an encrinite for half a century. That all my theory of temperature will hold, I am not so sanguine as to dream. It is *new*, bran *new*. Give Humboldt due credit for his beautiful essay on isothermal lines: the geological application of it is mine, and the coincidence of time 'twixt geographical and zoological changes is mine, right or wrong. Sedgwick and Murchison have found an intermedial formation in Eastern Alps 'twixt chalk and oldest tertiary, helping to break down that barrier, to fill that lacune. Until Rennel's posthumous work on currents is out, I could not have a good copper-plate of their course. Thanks for the hint, which shall not be lost, if your review helps me in spite of the saints to a second edition, and in spite of 1,500 copies, a number I regret but could not avoid. My labour has been greater than you would suppose, as I have really had so little guidance. *Your little valley paper was one of my best helps.* I mean as guide in classification of facts. I was afraid to point the moral, as much as you can do in Q. R., about Moses. Perhaps I should have been tenderer about the Koran. Don't meddle much with that, if at all.

If we don't irritate, which I fear that we may (though mere history), we shall carry all with us. If you don't triumph over them, but compliment the liberality and candour of the present age, the bishops and enlightened saints will join us in despising both the ancient and modern physico-theologians. It is just the time to strike, so rejoice that, sinner as you are, the Q. R. is open to you. If I have said more than some will like, yet I give you my word that full *half* of my history and comments was cut out, and even many facts; because either I, or Stokes, or Broderip, felt that it was anticipating twenty or thirty years of the march of honest feeling to declare it undisguisedly. Nor did I dare come down to modern offenders. They themselves will be ashamed of seeing how they will look by-and-by in the page of history, if they ever get into it, which I doubt. You see that what between Steno, Hooke, Woodward, De Luc, and others, the modern deluge systems are all borrowed. Point out to the general reader that my floods, earthquakes, &c., are all very modern, also waste of cliffs; and that I request that people will multiply, by whatever time they think man has been on the earth, the sum of this modern observed change, and not form an opinion from what history has recorded. Fifty years from this, they will furnish facts for a better volume than mine. The changes in organic life, which I intend to be more generally entertaining than the inorganic, and more new, must be deferred to Vol. II. I will attend to your other requests immediately.

Very truly yours,

CHARLES LYELL.

P.S.—I have been very careful in my work in referring, where I have borrowed, to authors, and am not conscious of having ever done so without citing in a note. I doubt whether I have embodied sentences from any author so much as from you, and you will see that that is in great moderation.

I conceived the idea five or six years ago, that if ever the Mosaic geology could be set down without giving offence, it would be in an historical sketch, and you must abstract mine, in order to have as little to say as possible yourself. Let them feel it, and point the moral.

To POULETT SCROPE, ESQ.

London: June 20, 1830.

My dear Scrope,—I go on Tuesday morning to Havre, for the Pyrenees. I trust you will agree with me in what I have said in the winding up of the chapter on the Calabrian earthquake of 1783 as to excavation of valleys. I have never seen this subject touched on in all the theories of valleys—compare my allusion to the land-slips in the Batavia shock in 1699. Forests floating on the sea in Jamaica speaks also volumes as to effect on valleys. Whewell tells me he has just been at Oxford, and with a cavalcade of forty horsemen went out for Buckland's field lecture. He held forth more than ever about the impotence of modern causes. Had he and Conybeare been engaged to review me, they might positively have done some harm in *retarding* the good cause, and much more in stopping the sale of a certain number of copies.

In the volcanic causes, the only material thing for which I am indebted to Von Hoff is the tracing out the volcanic regions more fully than is found in other books. As to the philosophy or geology of volcanoes, he gives nothing that I have thought worth borrowing, and he attempts but little. Daubeny had seen it, but profited less than he should have done by it.

Whether my concluding theory of excess of subsidence will do, is more than I can predict. Like many others, it is my own, and thought out after turning the subject over in every way. I have not had time to study Elie de Beaumont's dashing theory of Epochs of Elevation, but have seen enough to be sure that much of it will not stand. The review of his notions will come properly in my next volume, for it is by fossil zoology alone that all dates of the relative upheaving of mountain chains must be decided, or guessed at. It is preposterous to say that the Alleghanies were raised when a certain European chain was, *because* they are parallel. He runs riot in these extravagant generalisations, just as he compared the Dauphiny Alps to the mountains in the moon, in sober earnest. E. de B. does not, as far as I can see,

entertain any suspicion that before laying down as an axiom that 'parallelism of axis of elevation indicates contemporary elevation,' some respect should be had to what may now be going on; or if we know too little as yet, at least let us wait. I expect to come into collision with his doctrines, for he seems to me to be embarked just as Von Buch was, in his 'Elevation Crater' system, on the plan of speculating on ancient times without caring about modern causes. Think of his saying that *the Deluge* may have been caused by the sudden rise of S. America! I respect him as one of the best of the young Frenchmen. He has done much good, but three-fourths of his theory won't stand five years. I am more anxious than I can tell you that you should hit it off well for Q. R. Of such an article as many reviews would jump at, there is no fear; but if Murray has to push my vols., and you wield the geology of the Q. R., we shall be able in a short time to work an entire change in public opinion.

Ever very truly yours,

CHARLES LYELL.

To POULETT SCROPE, ESQ.

Havre, France: June 25, 1830.

My dear Scrope,—Not being able to cross over to Honfleur to-day, because of tide not serving, I have seen all the geology which the cliffs afford. Chalk capping, under which Upper Green Sand just as in the back of the Isle of Wight, and blue marl at bottom raised in same manner by undermining—tide rising 22 feet, and sweeping away land 500 feet high. Having done this, I took up Elie de Beaumont's new work, published in 'Ann. des Sciences.' Now I am somewhat glad to find how much my views differ from his. In his memoir entitled 'Recherches sur quelques-unes des Révolutions de la surface du Globe,' &c., he begins by saying, that whatever be the causes which have raised mountain chains and put the beds composing them into their present position, it must have been 'un évènement d'un ordre différent de ceux dont nous sommes journellement les témoins.' In my comments on the Huttonian theory, I throw out that there have been, in regard to separate countries, *alternate* periods

of disturbance and repose, yet earthquakes may have been always uniform, and I show or hint how the interval of time done, may make the passage appear abrupt, violent, conclusive, and revolutionary. Now E. de Beaumont's reigning notion evidently is, that because 'le redressement des couches s'arrête brusquement à tel ou tel terme de la série des couches de sédiment (in different chains), et affecte avec une égale intensité toutes les couches précédentes, le phénomène de redressement n'a pas été continu et progressif, mais brusque, et de peu de durée,' &c. Now it is undoubtedly brusque as far as the solution of continents, but why therefore the 'convulsion' of short duration? I do not find anywhere in him the notion of restoring in imagination the geographical features of Europe of N. Hemisphere by causing the land to sink, which has been since upraised—as to change of climate he has nothing to do with it. I told you before, that I have, as far as I, and others whom I have consulted know, to answer for all the sins committed in that new theory. Before I dared hazard it, I went to Stokes, who has often condemned my follies to the flames, but he said 'he was sure there was much in it, and might be as much as I thought. At all events, it would do much good to try it, and would set others to work.' E. de B. gets hold of three or four chains, proves that one has been elevated since the Jura limestone, another parallel since the chalk, and then infers that they were upraised nearly about the same time, and, as they are parallel, he thinks it *very probable* that these accidents of the surface, which have a community of direction, 'ont été formés pour ainsi dire du même coup, et sont les traces d'une seule et même commotion.' 'Ann. des Sciences Nat.' tome 18. Whatever may be said of my theories, there are sweeping conclusions in E. de Beaumont, for which I would not be answerable for a good deal. At the same time his work is in many parts, as far as I can judge without being able to test the facts, of great merit. It is difficult to follow him, and for so new a subject he has been I think unpardonably concise, and therefore obscure in laying down his views. I do not half comprehend what he would be at, yet I have talked much with him on geology in general. My confidence is shaken by knowing that he is an unflinching

follower of Von Buch's, in theory of 'Elevation Craters.' I mean to make almost straight to Olot in Catalonia, but my companion, Captain Cooke, must go and see the Druidical monument at Carnac in Normandy. This out-of-the-way line will cost some extra days, but you shall hear in five or six weeks of the volcanic region. I shall be surprised if Olot was destroyed by lava, or an eruption—probably an earthquake, but if lava, so much the better. I will see what the river has done in three centuries.

With remembrances to Mrs. Scrope,

Believe me ever truly yours,

CHARLES LYELL.

To HIS SISTER.

Toulouse: July 9, 1830.

My dear Marianne,—I arrived here yesterday after having traversed from Honfleur to Bordeaux, a great part of Normandy, Brittany, and La Vendée, on the most detestable roads, and through some of the finest countries I ever saw. It is common to see waggons with nine horses unable to move the machine out of deep ruts. In the diligence twenty persons had to turn out several times in the mud, during heavy storms, to let the carriage be dragged out. My companion, Captain Cooke, took me this round-about, to see the great Druidical monument of Carnac, near Quiberon Bay, which is a fine thing, though we have paid dearly for it in time, &c. However, I learnt of course something of the geology of the countries we went through. Cooke is a commander R.N., son of a country gentleman near Newcastle, well informed, a good linguist, knows Spain, a botanist, and gets on in geology. He is a little too fond of lagging a day for rest, as here where nothing is to be done. But such peccadilloes I pardon for his manifold virtues. At Bordeaux we learnt a great deal; the place abounds in geologists, full of zeal, and their museums and conversation were very instructive. Here we have a great gun of the old Wernerian school, D'Aubuisson, who amuses me much. He thinks the interest of the subject greatly destroyed by our new innovation, especially our having almost cut mineralogy and turned it into a zoological science. In short, like all men, he dis-

likes that which destroys his early and youthful associations, and he has too much to do as an engineer to keep up with the subject. It is what they call cold unseasonable weather in the south of France, but just what we like. The verdure is splendid and probably very unusual here. Fruit half ripe, vines promising no crop for want of sun. Instead of suffering by heat, they tell us we shall be too cold in the Pyrenees. The line of huge blocks at Carnac are nearly as big as Stonehenge in parts, and, forming ten rows, reaches four or five miles in a direct line E. and W. How they got them up is marvellous; some are twenty feet high. We go to-morrow towards Ax, meaning to make a short excursion to a volcanic district round Olot in Catalonia, where Cooke has already been as a botanist; we then return to Bagnères de Luchon, and then to Pau—future movements in the Pyrenees will be governed by what we find in our first excursion. I hope to receive news at Bagnères de Luchon, and hear whether my book comes out or not. I shall be glad to hear your honest opinion of the work, regarded as one comprehensible to the uninitiated. I am afraid that what delights my friend Scrope more than all—the honest history of the Mosaico-geological system—will hurt the sale. D'Aubuisson said this morning: 'We *Catholic* geologists flatter ourselves that we have kept clear of the mixing of things sacred and profane, but the three great Protestants, De Luc, Cuvier, and Buckland, have not done so; have they done good to science or to religion?—No; but some say they have to themselves by it. Pray, gentlemen, is it true that Oxford is a most orthodox university?' Certainly. 'Well then, I make allowances for a professor there, dividing events into ante and post-diluvian: perhaps he could get no audience by other means.'

This attack against Buckland convinces me that the French Institute chose Conybeare before Buckland, because they considered the latter as trading in humbug, which I am sorry to say is notoriously true of Cuvier, but not of Buckland, for although I am convinced he does not believe his own theory now, to its full extent, yet he believed it when he first started it.

The quiet and perfect order and calmness that reigned

at Bourbon, Vendée, and Bordeaux and Toulouse during the heat of the elections, afford a noble example to us—never were people in a greater state of excitement on political grounds than the French at this moment, yet never in our country towns were Assizes conducted with more seriousness and quiet. There is no occasion to make the rabble drunk. All the voters of the little colleges are of the rank of shopkeepers at least, those of the highest are gentlemen, only 20,000 of them out of the 30 millions of French. They are too many for such jobbing as in a Scotch county, and too independent and rich to have the feelings of a mob. This city has elected all seven ministerial men—a rare case. The little colleges have in general elected four out of five opposition, the great colleges four out of five ministerial. The former are the democratic body, yeomen, merchants, &c. The landed interest is in the greater college. The number of royalists here is attributed to the personal influence of the ex-minister Villèle. A gentleman told me at dinner to day: 'Villèle is the only man Charles X. can choose. Polignac must yield. Villèle lost his place not by the censorship of the Press, nor by the law of sacrilege, nor by any of his unpopular ecclesiastical measures, however impolitic some of these may have been, but he lost it by his bill of primogeniture, a necessary measure for the salvation of France, but so hostile to the feelings of the people, that it is at the bottom of much of the opposition now manifested. Every family is in arms about this measure; yet we shall be ruined if this partitioning goes on for ever.' I have been amused at their telling me that Polignac, when in England, became an ultra-aristocrat. They say that Chateaubriand made a stand against Almack's and the exclusives, but that Prince Polignac gave into it, and as the Stewarts lost their crown by the monarchical lessons taught in France, so P. will lose his premiership by the ultra-aristocratical notions taught by the D. of Devonshire. Think of a Frenchman reasoning in this manner!

Love to all. Your affectionate brother,

CHARLES LYELL.

To His Sister.

Prades, near Perpignan, Valley of the Tet : July 21, 1830.

My dear Caroline,—I believe it is an age since I last wrote, which I believe was addressed to Marianne from Toulouse. Thence we went by a baddish diligence to Foix on the Ariége, one of the most picturesque places on the northern flank of the Pyrenees. From thence we went to Ax, one of the great watering-places. I got two famous days' geology on that side of the mountains, and we filled a small box full of good fossils, which will throw light on the chain, of which I got a clear idea, as to structure.

There is something in the general character of the deep valleys of the Pyrenees, different from what I remember in other chains, or rather the characters which belong elsewhere to minor valleys and those in rocks of a distinct nature, happen here to acquire a grand and Alpine scale. After Ax, where we found a number of French strangers, not like our loungers at watering-places, but really invalids, we ascended from the region of oaks and beeches to that of pines. A forest of silver firs was covered with the lichen, which I think we used to call in the New Forest 'old man's beard,' some of them being several feet long. I admired them so much, that Cooke was amused not a little. He is a great fancier of pines, and has discovered two or three new kinds, and looked on the lichen as a loathsome disease. He has rather a fancy to begin insect-hunting, and I could hardly persuade him that if we set up a net, there would be an end of geologising. When we got into the centre of the chain, into the granitic region, I was glad to relieve *ennui* by joining him in catching those which were polite enough to offer themselves without trouble, and I have put them up in paper as Alpine kinds. We travelled on mules over the central chain, and then entered French Cerdagne by the valley of Carol. We went to Bourg Madame, as it is now christened, a village burnt by the Spaniards during the late war. On this frontier, close to Puycerda, we discovered a freshwater deposit unknown before, of considerable extent, filling an enormous valley, and containing animal, or at least testaceous

remains, and wood. Although an old affair, and with a valley 500 feet and more cut through it, the nests of planorbis and lymnea and the whole aspect of some beds are singularly like the Loch of Kinnordy. We heard from good authority an unfavourable account of the state of Catalonia, where there are three parties it seems—the constitutionalists, who think King Ferdinand too despotic; the royalists, who consider him as the best of all possible kings; and the Carlists —I fear the strongest party—who consider him as not half despotic enough, and who would re-establish the Inquisition in full force. We were dissuaded from entering at present, and as Cooke feared to descend to the eastern extremity of the Pyrenees because of the heat, he kept upon the hill tops among his favourite pines, intending to visit the valley of Andorra, and then to go to Bagnères de Luchon, where our letters await us, and where I am to join him. My work was clearly in this region, and to-morrow morning I shall be at Perpignan. This cool season, the heat is positively a mere trifle even down here in comparison to what even Murchison worked regularly in, in Auvergne, Vivarais, and the Vicentin. As for me, I have only been just warm hitherto. My present scheme is to see the valley of the Tech, Tet, and La Gly, on the eastern extremity of this chain, and the newer formations at their foot near the sea, then to see the flanks of the chain, always the most interesting point to a geologist who is not too fond of mere mineral hunting, and so to get to Bagnères de Luchon in seven, eight, or more probably ten or twelve days—all which time I shall be without news from England since my departure. I have got through part of the Spanish grammar, probably to small purpose, except at some future time. I must get a cram in pronunciation from Tom. My companion has been very agreeable, but, as you may suppose, not quite so far gone in geology as to be inclined to keep it up with as much spirit as I do, and I doubt not I shall make great play now I have got sufficiently interested in the study of this magnificent chain, to care less for the birth of my book than I did *en voyage*; but in writing to you, I am curious again to know whether it is out, which I shall not learn for some two or three weeks, or possibly more. What I saw of the Spanish

peasants in the valley of Puycerda, pleased me much, with their red bonnets, fine sunburnt countenances, swarthy almost, and active mountaineer walk. They make capital guides, and will beat a horse in a day's journey in the hills. I need hardly say that my pure Castilian did not aid me much in interpreting their language, but Italian did much. Yesterday I was among pine woods; to-day, olives, vines, wild pomegranate, &c.

With my best love, believe me, your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Perpignan: August 8, 1830.

My dear Fanny,—I have just returned from a successful expedition into Catalonia. I believe I mentioned in my last that Cooke and I separated, after finding it impracticable to get into Spain, and after losing three days in the vain attempt. Encouraged by some Catalonian gentlemen here, I went in two days by diligence to Barcelona. A glorious view of the Pyrenees and of the delicious country bordering the Mediterranean to the south. The heat so great, that five Cuba merchants, my companions, pronounced it beyond that of the tropics. It did me no harm. We were fanned by machines at breakfast and dinner as in India, went without coats, drank incessantly, perspired while sitting still as if in full exercise; but there was so much novelty in all to me, that I never felt my energy flag. As I entered Barcelona on a *fête* day, I was struck with the gentlemanlike appearance of the numerous priests, a fine, venerable-looking set in general, respected by the people, so different from the poor, sneaking clergy of France, who look as if they had no business in the country. The garrison, 8,000 strong, was in full review in honour of the Queen's birthday, before the Conde d'Espagne, an officer who distinguished himself under the Duke of Wellington in Spain, and who is looked up to as the main instrument of ridding Spain of the last French invasion, by outdoing the French in diplomacy. He was covered with orders. About 2,000 of the Royal Guard were among his troops—a mark of the high favour he is in.

The next morning, July 24, I called on the Count at the Palace, with Stephens, an Englishman, a great favourite at Court. He, d'Espagne, is obliged to be very inaccessible, or he would be mobbed, but his regard for the English ensures them a polite reception if recommended to him. As Stephens was intimate with Vyvyan and other brother Oxonians, and as I was the companion of Captain Cooke, a friend of d'Espagne, I met with great attention from the Count, who is Captain-general of Catalonia, and has more power than an Irish viceroy in that great and populous province. He called the next morning and left an invitation to dinner. I dined with him both that day and the next, and received from him a special passport signed by him, and letters to Governors, Abbots, &c., and was pressed to take with me one of his body-guard. 'I can ensure you respect from the authorities, but no magistrate can guarantee you against the brigands. You will have heard that we are not troubled with many now, but in the mountains, a district of smugglers, who can say what may happen? For my sake, and that I may feel at rest, do not refuse.' I accepted, but when the Captain of the Guard came with the 'Mucho,' I declined, as I felt no insecurity, and as not one of the guard could speak French, nor serve as interpreter. With a mule and a guide on foot, who knew a few scraps of French, together with a few sentences of broken *patois*, and Italian of my own, I got on without one misadventure through a glorious country for a geologist. Saw Monserrat, the salt mines of Cardona, Vich, and the volcanic district round Olot, and returned across the Pyrenees by Massanet to Ceret. A naturalist at Olot, who had written on the volcanos, talked French well. I re-entered France, August 7, and find that in my absence a great revolution was accomplished. The tricolor flag hoisted on all the churches, and the utmost order prevailing, without any apparent apprehension even on the part of the royalists as to security of person and property. I am not a little glad that I saw what I have seen in Spain before this news reached them. For whether there be a convulsion or not there, the apprehension which the authorities entertained had got to such a pitch even before I quitted, that but for the Captain-general I might not have got out again so soon;

delays to travellers will at least be multiplied. I must tell you my adventures and what I saw in Spain in future letters, for it was a tour full of novelty. The sort of feeling one has there of the government and laws and state of the nation is such, that the topsy-turvying of all things here seems a trifle to me in comparison. Here you know everything, but in Spain there is a darkness and mystery, and an evident sense of danger which makes you uneasy; and had I not been excited unusually by the scene and the important geological facts I learnt there, I should not have enjoyed it as I really did throughout the whole fortnight. I have got so interested now about the Pyrenees, that even the seeing in the newspapers how a dynasty had been upset, or rather how they had upset themselves, seemed a milk-and-water affair in comparison. I hope to keep in this mood till in a few weeks I have run along the flank of this fine chain to Bordeaux.

Although the Prefect, Sub-Prefect, and almost all the lower officers here have been already dismissed and replaced, I got my passport this morning with such promptitude, that I cannot but admire them. They seem determined that the machine shall work well in the midst of so complete an overturning of the old hands, or out-turning. The outs even do not pretend that they are in any apprehension here, and other travellers are moving about with perfect confidence. No one has been even scratched here, and the troops are in perfect good-humour, though they kept up the old flag in the citadel, or at least refused four days to put up another until ministerial orders came, expressly commanding it.

The only popular act of violence here has been the pulling down the crucifix erected by the congregation. I expect to hear they have done this almost throughout the country; it was the banner of a party which has chiefly ruined the old *régime*.

With my love to all, believe me your affectionate brother,

CHARLES LYELL.

CHAPTER XII.

AUGUST–NOVEMBER 1830.

VOLCANOS OF OLOT—EARTHQUAKES—COUNT D'ESPAGNE—CORK-TREES ON THE FRENCH SIDE OF THE PYRENEES—PINE-TREES—POLITICAL STATE OF THE COUNTRY—EXPEDITION TO MONT PERDU—LETTER TO SCROPE ON GEOLOGY—RIPPLE-MARK—PARIS—LOUIS PHILIPPE—POLITICAL AGITATION IN BELGIUM AND FRANCE—STUDYING SHELLS WITH DESHAYES—DISTURBANCE BY THE MOB—RETURNS TO LONDON—SCROPE'S REVIEW IN 'QUARTERLY'—REMOVES TO RAYMOND BUILDINGS.

CORRESPONDENCE.

To POULETT SCROPE, ESQ.

Bagnères de Luchon, Dépt. de la Haute Garonne: August 10, 1830.

My dear Scrope,—As I have just returned from the Spanish side of the Pyrenees, I will not delay thanking you for your suggestion that the Olot volcano should be visited, a hint which has turned out fertile in good results to me, not only in regard to igneous rocks. After working a little on the Ariége from the plains of Toulouse, up to the source of that river, from the tertiary at the base of the chain to the granite which separates France from Spain, I descended with my companion Captain Cooke to Puycerda. . . . But I must now tell you something of the volcanos of Catalonia. Like those of the Vivarais, they are all both cones and craters, subsequent to the existence of the actual hills and dales, or in other words no alteration of previously existing levels accompanied or has followed the introduction of the volcanic matter, except such as the matter erupted necessarily occasioned. The cones, at least fourteen of them mostly with craters, stand like Monpezat, and as perfect, the

currents flow down where the rivers would be if not displaced. But here, as in the Vivarais, deep sections have been cut through the lava by streams much smaller in general, and at certain points the lava is fairly cut through, and even in two or three cases the subjacent rock. Thus at Castel Follet, a great current near its termination is cut through, and 80 or 90 feet of columnar basalt laid open, resting on an old alluvium, not containing volcanic pebbles, and below that, nummulitic limestone is eroded to the depth of 25 feet, the river being about 35 feet lower than when the lava flowed, though most of the old valley is still occupied by the lava current. There are about fourteen or perhaps twenty points of eruption without craters. In all cases they burst through secondary limestone and sandstone, no altered rocks thrown up, as far as I could learn, not a dike exposed. A linear direction in the cones and points of eruption from north to south. Until some remains of quadrupeds are found, or other organic medals found, no guess can be made as to their geological date, unless anyone will undertake to say when the valleys of that district were excavated. As to historical dates, that is all a fudge. I found out the man who provided Maclure with all his antiquarian information, and after reading it, I can assure you that there never was an eruption within memory of man. There was an earthquake from south of Olot to Perpignan about four centuries ago, of which the exact date and all the circumstances are known. It did not do serious damage except at Olot, where the whole town, save one house, *fell in*. So it may do again, if such a shock as rent every house in Genoa in 1829, and shook the Apennines and Piedmont, should return, for there are underground passages, and subterranean rivers, and grottos, and hollow mountains, in which the 'rimbombo' is remarkable in the suburbs and environs of Olot. I say *fell in*, for houses and monasteries sunk *entire* into the ground, and have been dug out, their roofs on a level with the soil, within the time of men now living there. No shock or even tremor has been felt since, so that although Olot is far from the great line of fire, I do not think that earthquakes invalidate the rule, that at a distance from the great line, the shocks are *rarer* and less violent. The hollow foundation was an accident

owing to volcanic eruption perhaps of another epoch, certainly very ancient.

Believe me, dear Scrope, yours ever most truly,

CHARLES LYELL.

To HIS SISTER.

St. Gaudens, Haute Garonne: August 16, 1830.

My dear Eleanor,—Before I forget my Spanish adventures, I will tell you a few of them before they get too stale. Since I re-entered France I have heard nothing but abuse of the Count d'Espagne, from whom I received so much attention. On my arrival at Perpignan, I found that the Count's cousin-german, Baron Raimond, Prefect of the Department, had fled in disguise to Barcelona. He has left behind him the character of a man of business and talent, but a tyrannical instrument of the late ministry. He was most detested for having thrown seven Spaniards—refugees—into prison, where they had remained half-a-year, unable either to obtain a trial or accusation, or any notice of their offence. All declare this was done at d'Espagne's instance. The prisoners were released when Baron R. fled, and I got acquainted with one, a gentlemanlike well-read man, both in French and English literature, apparently rich, a thorough Spaniard, and proud of his country. He declared that d'Espagne was a sanguinary partisan without ability, that he was a Frenchman, never more than a colonel when the Duke of Wellington was in Spain, and that he owes his elevation to accident, &c. My own opinion, after conversing on many subjects with him (d'Espagne), was, that he was well-informed, but far from a man of first-rate talents, and if he is comparatively so in Spain, it would lead me to suspect that *dans le pays des aveugles les borgnes sont rois.* In Catalonia they give him credit for getting rid of the French by his diplomacy, and for having shot indiscriminately the *priests* as well as laymen, who were murdered in an insurrection which the King sent him to quell. To the fear inspired by his defiance of the ecclesiastics, many impute the tranquillity which reigned afterwards in his province. The Carlists or high-priest party hate him, but they fear him

much. To their dislike, however, I rather impute the failure of our entry by Puycerda. I believe I never told you the particulars. When Cooke and I reached the frontier, we went immediately to the Alcalde of Puycerda, to get our passports regularly signed. This Mayor or Justice of Peace (for I believe he serves in both capacities in Spain) kept us two hours waiting, and then said he could not sign till next morning, though he could not make any objection to our passports, which were quite *en règle*. Next day we waited as before, and were then examined and cross-examined, as to our objects, &c. The slow and dignified air of the worthy magistrate were so diverting, that Cooke, who was not so keen as I to employ the time otherwise, thought himself well repaid. We were remanded for a third interview, but it was agreed that Cooke should go, while I geologised, and had a good day's work. On that day Cooke found a priest with an immense shovel hat on the bench with the Alcalde, who cross-examined in a most inquisitorial way, and said that our objects seemed suspicious. 'That he, a captain in the British navy, should travel for stones and plants, neither he nor his companion being *Médecin*, or *Agent des Mines*—that a society was organised in London for disseminating liberal principles of government throughout Europe—how was he to know we were not Commissioners? They had orders from Madrid,' &c. &c. Cooke showed an old passport from d'Espagne, and offered to send an express to Barcelona, but was told we must both appear before them the day after, *i.e.* the fourth day! The director of the French Douane now entreated us not to go. 'You risk your personal safety; they often throw foreigners into prison, and when it is found that they are innocent, they let them out to be sure, but no other redress. I will go to the commandant of Puycerda, who is indignant at their treatment of you, and he will guarantee your personal safety and your return to the French frontier well and good.' The military commandant, a man of family, and very gentlemanlike, said he would rather decline a squabble with so troublesome a parvenu as the Alcalde. So we demanded our passports to be returned, but the devil a bit would he give them up. 'As to the Conde d'Espagne,' said the great man, 'I receive

my commands from a higher source, *from the King himself!*' When this was afterwards told d'Espagne, he said, and the saying soon reached Puycerda, 'I wonder it never occurred to him that as I happen to be on the top of the ladder, and he at the bottom, I may kick him off.' The fact is the Mayor was a Carlist, an inquisitionist, and his hatred got the better of his prudence. We went without our national passports, and, but for Baron Raimond's politeness at Perpignan, I should never have got into Spain. After such a warning, I made a complete study of the police, and took every precaution, by getting d'Espagne's special passport, &c. Once every day a signature must be got, which is often very awkward, as when the rivers were impassable, and I was sheltered in a miserable hovel far from any mayor or magistrate. But the most annoying event was on my return. I had taken pains to get not only my passport and the guides, but also the passport of Mons. le Mulet, *en règle* at Olot, but was told that the latter would require another signature on entering France. When I got to Massart I was told I could not pass unless I got another horse. I went to the Alcalde in no small rage. Luckily he could speak French well. I showed him all my letters from d'Espagne, pass, &c., and said that the Mayor of Olot had insured me against any delay. Like all Spanish authorities, he first was very dignified, made me sit down, and then wrote a letter and gave orders about other matters. This I am told they always do, lest by attending to you at once, they should let themselves down. But at last he stirred in right earnest, insisted on my guide taking a day's less pay, and got with some trouble another beast, who happened to be provided with a proper passport. 'I could sign your passport,' said he, 'but have not authority to sign your mule's. There is no magistrate nearer than S. Lorenzo (half-a-day) who could give you that!' What a glorious state of political economy! yet they are quite right. The priest and Mayor of Puycerda frankly told the French Douanier that 'the fewer English and French who travel in Spain the better,' and so it is for their views. By prohibiting books, travelling, internal circulation, of commerce, &c., they may retain their absolute dominion some years longer, and I shall not pity them if they are

then hurled down from their place like the *Parti prêtre* in France. I must defer a curious religious ceremony which I saw till next letter.

My love to all. Believe me your affectionate brother,

CHARLES LYELL.

To HIS FATHER.

Bagnères de Luchon : August 17, 1830.

My dear Father,—I arrived here last night, and found that Captain Cooke had had the patience to wait here. Had he known, he says, how much I should accomplish in Spain, he should have braved the heat. We are now going to work at the Central and Western Pyrenees. The excursion to Spain I prize the more, as the gates are now closed upon us; at least no prudent man will now venture across the frontier. There is such excitement in Andalusia, that whether it pass off or not, the facilities of travelling are at an end. On my way from Perpignan to Barcelona, on the French side of the Pyrenees, I passed for many miles through a great forest of cork-trees, with some ilex intermixed, and I came back through a much larger wood of cork in returning from Olot to Cerat in the valley of the Tech. Some were as large as good-sized oaks, and more like old olives than I had imagined. I was surprised that the bark was only red when the outer bark had been taken off for cork, so that the red colour spoke of in Southey's 'Don Roderick' is due to laceration. I suspect that Mr. S. got his information second-hand, and was not aware that it was no characteristic of natural scenery, that the white bark is more picturesque, and that the partial removal of so thick a rind has a very bad effect in the landscape. The old trees are quite disfigured by it; he has been guilty of singing the praises of the mere result of commercial industry, and might be annoyed if he knew how unpoetic and vulgar a feature he has seized upon. It was a very fine country I went through, and I had several days of wild rides from Cardona to Olot, by mountain pathways through endless woods of pines and olives mixed and some fine ilex. It looks much in the state of Sicily, but perhaps farther advanced. The heat is shown by the fact that there are machines for fanning you and driving off flies as you eat;

milk, butter, coffee, or tea to be got anywhere, but strange to say you can get a better cup of chocolate than you could often meet with in France, in a poor peasant's house, for a small sum, and made in five minutes. Their brown bread is not so black and bad as in Sicily, the wine generally good and cheap, the meat very bad, cost of living about the same as in France, but less fair dealing in small places. Although the French journals pretend the contrary, their national prejudices, especially against them, are very strong in all parties, high and low. In fact they are ignorant, and immense pains are taken to keep them so. The gravity with which after consultation, my dictionary and Spanish grammar were allowed to pass, the only books I had, was diverting. Yet the arts of writing and reading appear to be pretty generally spread among the poor in Catalonia, and they are advancing. As I knew d'Espagne might feel it as a slight if I declined one of his guards, I determined to see if there was among them a good interpreter, in which case it might have been worth while. As Catalonia is on the frontier, and the French were settled there longer than in any other part of Spain, I fancied it impossible that out of the hundred men one should not be found to speak French. The barrack was a curious scene, a swarthy race of most active-looking armed mountaineers. They carry a small rifle and a cord with a loop, which they throw over the head of any one they pursue, much like the lasso of South America. This singular weapon of the police gives them immense advantage in pursuing an enemy up hill. As each group was asked if any one of them could speak French, they replied with a kind of shout, *Somos Catalanes*, a little indignation being felt at the very idea of such an unnational acquirement. Even in the enlightened city of Barcelona, a *Castilian* is regarded as so far a foreigner that genteel families from Castile, settled there, find the *national* prejudices much against them in society! The abbé of Monserrat moaned over the splendid monastery which the French had levelled to the ground by their cannon *in bello independentiæ* (he talked Latin to me), and over the reduction of his friars to the small number of three hundred! And how many had you before? Nine hundred! On the top

of a hill 3,000 feet high, singing morning, noon, and night, in an empty church! They have rebuilt the convent in a vulgar square house, like an enormous manufactory. At Olot I arrived on the *fête* day of the Patron Saint, and saw the procession well from the balcony of my friend the apothecary, Bolos—what a good name for a pharmacien! His daughters, even the youngest child, seemed to be so tired of such sights, that their only amusement was the interest I took in it. The standards of twelve saints of the town came first, with an image at the top of each. When the procession stopped, to chant before different altars in the streets, these standards were made to rest on the ground erect, by means of ropes connected, like the shrouds to a mast, with the top of the pole, and these ropes held by men and boys who balanced it in this manner. The children held small flags, and could not resist using them to fan themselves as the heat was great. When laughed at for this, they often made a drive at the boys round them with the sacred banners, then came a regular English scuffle. The combatants got beyond the length of their tether, the saint was tugged on one side, and the image of St. Stephen, after three swings, came within a few inches of my head in the balcony. The older men did not seem to scold the youngsters for this, as it seems a sort of saturnalia, and I saw several other similar rows. Before a long line of Carmelitans who were chanting, was a girl of about seventeen years, dressed in white, and with two immense white paper wings on her shoulders. She carried a great silver cross. 'Look out for the angel!' exclaimed Bolos's children to me, and sure enough there never was a better figure in any pantomime. A cherub who preceded the Capucins was nothing in comparison. One part of the procession was really imposing: it consisted of 'the devout,' private individuals, chiefly peasants, who volunteered attending, each with a long torch and with a brown cloak thrown over them. They went two by two, so that there was a long line of flame as far as the eye could reach in either direction. I observed to Bolos that there was much religion throughout Catalonia, though the French say there is less than in other parts of Spain. His reply was, 'C'est un pays de montagnes, monsieur.' Want of

space must cut short my Spanish journal till another opportunity.

With love to all, believe me, your affectionate son,

CHARLES LYELL.

To HIS SISTER.

Bagnères de Luchon: August 18, 1830.

My dear Caroline,—I have been writing a long letter to Scrope this morning with an account of the Olot volcanos, in what they agree, and in what they differ from those of ten other volcanic regions which we have both visited between Clermont and Capo Passaro. I was in Spain yesterday, having crossed the frontier a few miles on the summit of the ridge. All is quiet in Aragon, the French news universally known. Many of the people give the present king's ministry the credit of having wished several reforms, but of having been prevented by the ultra-priest-and-king-party at Paris. I wish this may be true. The climate here is almost cold, a sudden change from Barcelona, where the thermometer was for three days at 94° Faht. At Olot 90° and above. My mule was furnished with a pair of thick wooden stirrups, clumsy things which I fancied would be close and hot, but they were luxurious as keeping the sun from striking on my boots, which felt as if they must crack when exposed to his rays. Cooke tells me that the great forests of moderate-sized pines, mixed with Olives and Ilex, which I passed through in Catalonia, were all of *Pinus halepensis*. It is not so handsome as *Pinus pinea*, but resembles it. The old forests of the Pyrenees have suffered terribly by the axe, and will soon be annihilated. They have been magnificent, and are still fine here. Beech, silver-fir, and high up *Pinus uncinata*. D'Espagne is now near us here, having marched as great a force as he can muster to the frontier, for fear of an explosion at so critical a conjuncture. For my part I expect the troops will be as ready as any to set up a new order of things, the officers being very generally in favour of diminishing the power and revenues of the church.

What you mention about the election and the anecdotes of the mob-rule which I see daily in the papers, make me

ashamed of our system. The calm manner and the rational behaviour of the French in their last elections, when greatly excited, forms a proud contrast for them. Much public spirit was shown in placemen resigning or braving the threats of displacement, when ordered by the Prefects to vote for ministers. The south of France is more monarchical than the north, and they are relieved beyond measure at finding that at Paris the republican party did not muster stronger. They forget, however, that it was not Paris, but the Deputies who conducted the revolution. I have heard furious disputes. One day a fierce republican, a collector of the taxes at Ceret, was nearly silenced, and at last one of his opponents said, 'But in point of fact, sir, do you not anticipate the nomination of the Duke of Orleans to be king?' 'C'est probable, monsieur, car nous sommes toujours les singes des Anglais.' Did I tell you a Frenchman's comment on the removal of the cross of the mission from the Cathedral at Perpignan? 'Chacun a son tour, le bon Dieu a eu le sien.' An American here tells me that he was opposite the hotel of the Prefect at Bordeaux, when the mob nearly killed him. He kept his drawn sword in his hand the whole time. They threw his carriage and four fine horses into the Garonne. The latter of course were drowned. Not one person was killed at Toulouse, and the reports of deaths were all fables. I heard a dispute this morning in which a friend of Charles X. said, 'You stand up for the responsibility of ministers—well and good—how then can the king be responsible? If you punish his advisers, you must admit the principle "that the king can do no wrong."' The answer was severe enough. 'Monsieur, dans nos jours ce n'est que la canaille qui violent leurs serments en France.'

Believe me, your affectionate brother,

CHARLES LYELL.

To HIS MOTHER.

St. Sauveur, Pyrenees: August 25, 1830

My dear Mother,—Since I last wrote to Caroline from Bagnères de Luchon I have made with Cooke a successful expedition to near the summit of Mont Perdu, which is

within a few hundred feet of being the highest of this chain. As the last letter from Kinnordy told me you were reading my book without being pozed or wearied, I ought to tell you that besides affording the most picturesque scenery of these mountains, this celebrated point is of the highest geological interest, from its affording an exception to the general rule. In other chains the loftiest and central parts consist of rocks which do not enclose any remains of shells and corals, and you must go to the flanks or to the low grounds at their base in order to collect such objects. Here, on the contrary, you find at an elevation of between nine and eleven thousand feet, a profusion of sandstones and limestones, in the very middle of the Pyrenees, full of plants, shells, and zoophytes, many in so perfect a state, and in such thick beds, that you cannot doubt for a moment that you see the bottom of an old sea, now covered by glaciers, or so high that it supports no vegetation. There is one scene, the celebrated Cirque de Gavarnie, an amphitheatre of rocks with a high cascade on one side, which is quite unlike anything in Switzerland. On my arrival at Gavarnie, I had a fine view of this in a clear sky. The next morning we started for Mont Perdu. Having learnt that our whole time would be occupied with going and returning without leaving any time for work if we did not sleep on the mountain in a shepherd's cot, we resolved to do so, as other geologists had done. First we climbed up by steep precipices, and over much snow to a great rent called 'Orlando's breach.' Just before you arrive there, you must cross a glacier which is very steep, and overhangs a deep precipice. The guides had hatchets to cut holes, by which alone you can stir a step; in addition crampons are fixed to your shoes, and you have the usual alpine pole with an iron pike at the end. Six smugglers carrying burdens on their heads, and armed like ourselves with pikes, followed in our train, and reminded me exactly of my father's plate of the ascent of Mont Blanc of Saussure and his party. Roland's breach is an opening in a ridge or wall of limestone, which runs down from the summit of Mont Perdu about seven or eight hundred feet in height. You cross this portal from France to Spain in about forty steps, and you are carried at once to a new world as it were, a grand mountain view with

six distinct distances opening on the Spanish side. The foreground is a remarkable scene of desolation. Although not covered with snow, the rocks are bare, with scarcely a patch of green, not even on the most level parts. The anatomy of the hills is exposed in a manner very unusual, and very satisfactory to a geologist. You see that the strata, once horizontal, have not been carried up 1,000 feet without getting twisted and thrown about in the most confused manner. After a long day's hard work, and very improving, we crept into the Spanish shepherd boy's cabin. A small flock is sent up to feed on a few patches of green for about two months in the year. On the side of a precipice a hovel has been made, covered with turf in so rude a manner, that when we came to it, and it was pointed out to us, we looked for a long time and could not guess where the habitation was. You crawl in on all fours, as into a cave; the inside was ten feet by six, and about five feet in its greatest height. In this was made a fire of wood, the smoke escaping through chinks in the wall, and by the hole of the entrance, which is never closed even by a stone. The inside of this hut was smoke-dried quite black. We had each taken up a blanket, and kept up a fire all night, but unluckily there was not room for us, especially my companion, who is a head taller, to lie at full length, so we passed an uneasy night enough, and were not a little delighted when a second fine day enabled us to crawl out at sunrise. I am quite sure that had I taken two blankets and bivouacked instead, I should have slept sound after my fatigue, and another time I would always do this, for had we had a bed instead of hard stones to lie on, the being unable to turn and lie at full length would still have been painful for so many hours. The poor lad gave me a bag of hard oats to put under my head, 'because,' he said, 'I might find a stone (which was there for a pillow) not soft enough!' We of course had taken up provisions, for he had not even a drop of milk, and was obliged to go half an hour's distance for the nearest water, and three hours for a single stick of fuel. He passes two months with a child (his brother), is very happy, congratulating himself that he has not to sleep out like the smugglers, with the risk of imprisonment for life. It was matter

of no small regret to us that the present severity and delays of Spanish passports forced us to abandon our proposed continuation of the same line of observation down to the base of the Spanish side of the chain. When we returned over the glaciers it was necessary to make a new road, all the deep holes being filled with water which had frozen in the night. We brought back a famous quantity of fossil shells.

With love to all, believe me,

Your affectionate son,

CHARLES LYELL.

To HIS SISTER.

Bayonne: September 10, 1830.

My dear Marianne,—At Orthez we collected a good many fossil shells, and had a present made us of some by a French *propriétaire*, an amusing character. He took us to his marl pits on the summit of some hills covered with oak, fern, heath, &c., in short quite New Forest scenery, which reminded me of some similar marl pits near Stony Cross, where I used to hunt for shells. He had bought a good quantity of land very cheap, out of the savings as we afterwards learnt of a place of no less than 200*l.* sterling per annum, an immense thing in France, which he had got in the tax office from the minister Villèle, whose physician his father had been. He has turned agriculturist, and improved the estate very much. But he lives in hourly dread of losing his post, which we were afterwards assured he certainly would do, and his gloomy anticipations made him see all the late changes in a light which may be taken as a good example of what thousands of the 'outs' now feel in this country. We gave him a dinner at the hotel, and as he never suspected we should learn anything of his real history, he launched out without reserve, declaring that France had within her, in an unexampled degree, all the elements of happiness, but when things were well they could *never leave them alone*, that a *pure despotism* was the only form really suited to the French, and that Villèle was the greatest minister they ever had, that the deprivation of the Villèle peerages was not only illegal but *une sottise*;—

that persons now in place had not resisted the late changes, because on former turns out they had not changed more than the chiefs, but had it been known that all were to be upset, the revolution would have been withstood. To be quiet, it was supposed would have brought its reward with it. But the new order cannot last, &c. Then he uttered a furious tirade against place-hunting. 'Every shop-keeper has left Orthez for Paris, and each thinks he shall return a Prefect, or sub-Prefect at least. To be only a mayor, is what a cobbler would not condescend now to accept, if he is but a Liberal. As Lafitte is from Orthez, they all go up to him, to beg that so and so may be turned out to make room for them.' If clever men could talk like our little friend, it was high time that the demoralising effect of Villèle's system should cease. As for place-hunting, while men can buy estates out of the savings of a few years, there will be enough of that. If they want to cure the disease in part they must economise and reduce salaries.

Your affectionate brother,

CHARLES LYELL.

To POULETT SCROPE, ESQ.

Bayonne: September 11, 1830.

My dear Scrope,—I trust that neither the length of the article which the spirit has moved you to pen, nor the strength of the doctrines will prevent the editor from interposing it between me and that powerful party among us, who are nervous to a degree on certain subjects, and of whom even some of the moderates, have already hinted to members of our family, that my work, though certainly 'creditable to the author's talents, contains opinions that may well cause some alarm!' The decision of the Q. R. would settle the doubts of many of those good people, who only want to be told from authority what they *may* think. How I wish I could profit by the perusal of the slips, particularly on the part relating to the laws of running water, before I enter upon an explanation of experiments which I wish you to make, and which I should like to make the subject of a paper by Scrope and Lyell for the G. S., refer-

ring to it, if not concluded before, in my next vol., as about to appear! It will require patience to obtain all the results, but I am now more sure than ever that we may out of small and apparently trifling observations, if not construct, at least overturn many much-famed theories. I have for a long time been making minute drawings of the lamination and stratification of beds, in formations of very different ages, first with a view to prove to demonstration that at every epoch the same identical causes were in operation. I was next led in Scotland to a suspicion since confirmed, that all the minute regularities and irregularities of stratification and lamination were preserved in primary clay-slate, mica-slate, gneiss, &c., showing that before their transformation, they had been subjected to the same general and even accidental circumstances attending the sedimentary accumulation of secondary and fossil-bearing formations. Lastly, I came to find out that all these various characters were identical with those presented by the bars, deltas, &c., of existing rivers, estuaries, &c. Now, in my present tour, I have more in support of these positions than it would be possible in a sheet to explain, but I will just put down the facts and theories as they occur, *currente calamo*, and I do it, in full confidence that you will soon begin the experiments they will suggest. I have *igneous* experiments to suggest at another time. On the flanks of the Pyrenees is an extensive formation of vertical, curved, and contorted beds, of thinly laminated sandstone, sand, clay, slatey marl, slatey limestone, &c., all thinly bedded, as well as thinly laminated. The only organic remains in a thickness of many hundred feet are numerous and beautiful impressions of fuci. The sandstone slabs have almost all the ripple-mark, visibly and exactly preserved. The fuci are spread out conformably to the planes of lamination, bending with the undulations of the ripple-mark. The ripple-mark is strongest in the sands, and indicated by layers of mica. A section longitudinal to the furrows, and ridges, gives a slightly undulatory lamination: transverse, gives a wavy and curved line, and other figures common in primary and secondary rocks. An inspection whether of the surface or of the transverse section of the laminæ of a ripple-marked slab, shows at once that

such a disposition of laminæ is the effect not of the action of running water upon matter deposited, but on matter depositing. The general notion, I believe, has been that the furrows have been scooped out; it is not so, the ridges are made by addition, not the grooves by subtraction. Hence a difficulty may be got over.—How could 600 feet and more of ripple-marked beds be formed in succession? how could the ripple influence the bottom at such a depth? Answer, It arranged the sediment in that way near the surface, which fell through an undisturbed medium hundreds of feet in that form, and fell in that order on the bottom. Qy. If sand and mud be spread through a river, going at such a rate as to hold it in suspension, and a wind blows against it, and raises a ripple, does not this cause lines of retardation which cause matter to fall from the upper part in long coils? Try experiments. The ripple cannot penetrate many fathoms deep, may not its superficial effect or sediment be the cause? The ripple arrangement is seen in sandstone on very different scales of magnitude, from minute curves of a few lines to waves a foot and a half large each. I observed a strong ripple-mark on the sand of the river Gave de Pau, parallel to the bank at Orthez. I destroyed it in certain parts. Next day it was not renewed in those parts, but remained where I had not touched it. I effaced it on a sand-bar at the confluence of a mill-dam. In the evening, when the sluice was open, a muddy stream came down. Next day the sluice being shut, I found the new surface of the bar as deeply ripple-marked as the sea-sands ever are—and although it was soft sand and the water only 2 *inches* deep, a strong ripple of the river, washing over, did not in the least blunt or obliterate the undulations, yet loose grains of sand thrown into the hollow were immediately washed away. I threw sand and small pieces of dead leaves water-logged into a creek, the sands of which were ripple-washed, the depth of water being about six inches. The fresh matter was washed to and fro, sometimes all in suspension, sometimes thrown down irregularly, but every now and then all the vegetable matter arranged itself along the axis of the ridges, and waved backwards and forwards like sea-weed, as if growing in lines upon the top of the ridges. After

a whole hour of this movement there was no tendency of the newly-injected matter either to increase the ripple-mark, or to diminish it by settling in the hollows. It is evident that the preservation of the ripple-mark is consistent with considerable agitation of the bottom. In sandstones this peculiar disposition of laminæ is more marked and more general than in mud-stones. But if mud be deposited on an uneven surface, it will preserve the form of the mould. When shale and marl alternates with sandstone, they must be ripple-marked. Gneiss, as Macculloch truly says, does not in Scotland present in hand-specimens those small undulations so common in laminæ of mica-schist. May not this be that the granitic schists (gneiss) in which are much felspar, came from mud, aluminous clayey beds, &c.; those in which are only quartz and mica (mica-schist) from ripple-marked micaceous sandstone? This is thrown out as a guess.—I once saw the sand-dunes of Calais, which are from one to two hundred feet high, ripple-marked for acres, as distinctly as a sea-beach. This theory must apply to air, therefore, as well as water. It was fine-blown sand, and no vegetation on those parts to cause or interfere with the wind's motion. The sands had been moved recently at Ussat. I stirred up the fine sand of the Ariége. It rose in clouds, and the mica was seen suspended in thin broadish plates all parallel, and reflecting the sun quite in a blaze. They fell on a steep bank at last, which glittered with them. One should have lots of mica for experiments. I will get a box full from Scotland. Meantime pound up mussel shells, freshwater, which will do perhaps as well. A large and deep trough, with gently slanting sides, might enable us to experiment. Get a paddle-wheel which will turn with the hand, and make a ripple *ad libitum*, and sand and mud of different kinds to be deposited. Then we will afterwards mix matter in chemical solution. After a due series of failures, blunders, wrong guesses, &c., we will establish a firm theory.—Have you read Dr. Young's experiments on the arrangement of sand upon boards vibrating by different notes of stringed instruments? The symmetrical forms obtained are wonderful.

Believe me ever yours,

CHARLES LYELL.

To His Sister.

Bordeaux: September 20, 1830.

My dear Caroline,—I have received your letter on my arrival to-day, besides two epistles, one from Broderip, and another from Scrope. The latter informs me that Lockhart had allowed him three sheets for his article on me, and that he had printed and revised nearly *four*, an unconscionable length, which may probably incur the pruning of which he is very apprehensive; and though I expect a good article written *con amore*, I am much afraid there are parts which it may be prudent for the editor of the 'Quarterly Review' to omit, lest he should excite hostility from the Oxonians and others. There are some of my doctrines to which he demurs, though in general with me. As to my original receipt for heating up or cooling down our planet to the required degree of temperature, he was very animated against it in his first letter, but at last he fairly owns that he gives up the attack, 'that he shall not grapple with it at present, and though perhaps not true, it is certainly most ingenious,' &c. Broderip says he is making marginal notes for the second edition, of which therefore he makes sure. I am glad that even in vacation time they contrived to give Cuvier a public dinner,[1] at which Fitton was President, and Broderip vice-president, and thirty men, including all the eminent naturalists then in London, were there. In addition to his higher claims to such a distinction, Cuvier is always most attentive and hospitable to the English at Paris.

Cooke is gone into Spain, I suppose, this day, the very one fixed on by 17,000 Spaniards to enter, as they declare here, sword in hand. Ferdinand the beloved has just published, I am told, an *ordonnance* ordering any one they catch to be shot immediately, which is a good set-off against the late deeds of the brother Bourbon. 'The Spaniards,' says Cooke, 'conduct a war and even a revolution, with such slow and deliberate measures, that you have only to pass into the next province, and it will be weeks or months before the mischief is there.' I must say I would not go in myself, unless to

[1] At the Geological Society.

take part with the Liberals, to look close at them, and be able to give a true account of what I expect will be a serious business; but Cooke positively means to make a scientific tour, and he ought from experience to know how far it is practicable. I got him out three out of four wet days, along the cliffs south of Bayonne. On the last a tremendous surf, in addition to the heavy rain, cooled considerably what little courage was left in him; and although he soon revived again, I shall get on much better alone. Murray of Simprim said to me, 'Take care and get a companion, if you have one at all, on a short lease, renewable at pleasure.' I am happy to say we parted excellent friends, but I did not do the most geology in a given time when with him. Since I left Bayonne I found at Dax some famous French provincial workmen, and a very pleasant society. Delightful old oak forests, as wild as ours in Hants, interspersed with beautiful heaths, and here and there a tract of sand covered with pines, *pinus maritima*, the only one which will grow there. I think I never saw such fine old Roman walls and towers as at Dax. I made many acquaintances, and a geological discovery, with which I will not trouble you now.

I ought to have begun with the Bayonne cliffs, although the Parisians do not appear yet to have explained them well. There is the key to the Pyrenees, and God grant a revolution in Spain, that half of it may not be closed to geologists. Had I been alone I should hardly have made such a blunder as to begin in the interior, when there was a coast at hand exposed to the tides.

With love to all, believe me,

Your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Paris: October 2, 1830.

My dear Marianne,—I found all the world here, as you may easily suppose, full of politics, and on no other subject can they think or talk. Prévost, when I saw him first, had just been dining with the King, in the dress of a private of the National Guard, having been invited as the principal member

who happened to be in Paris, when the Geological Society have thought fit to go up with an address which Prévost penned. He sent a copy in to the *roi très citoyen* about an hour before. The reply, which was delivered *viva voce*, was very neat, and was in allusion to each part of the address, and in the same order. If Louis Philippe had not the gift of making these speeches, with the ease which he does, and always to the point, and just such as please the Liberals, his labour would have been insufferable, for the number he has had to make, and the variety of the subjects, is extraordinary. All agree that he plays his part as if born for the peculiar situation in which he now is. The difficulty of finding lodgings here now in hotels is considerable. The confluence consists in no small measure of place-hunters from the country, quite confirmatory of all I had heard in different towns of the departure of innumerable expectants of new promotions. This hotel is full of military men, called, as it were from the dead, the forgotten and proscribed campaigners of Napoleon, who are reinstated to a certain extent, those who were not too old, and who are now in part employed to drill the National Guard. A great many cannot get employment, and are praying night and day for the entry of the Prussians into Belgium, in the hope of the French being drawn into the affair. A finer opportunity, they say, could not have happened for 'resuming our natural limits on the Rhine;' but then they have a pusillanimous cabinet, and unless the people rise again, as they ought to do, there is great fear that the Belgians may be put down, and that the ex-ministers will not be condemned. Fine constitutional notions! The affair of Brussels has excited great interest here, and they contrive to persuade themselves that it is much more a counterpart of their own than it really is. The effect of these stirring news every hour has been that none of the French naturalists have thought of geology, and Prévost has made but little progress even in reading my book, which ere this he was to have half translated. He says moreover that he finds himself too little of an English scholar to be able without great labour to comprehend *les périodes soutenues* of the introductory essays. I found Deshayes excusing himself for having made no progress in naming my Sicilian and other shells, by his necessity

of working for his daily bread for encyclopædias, &c.; and having ascertained that his situation was very bad, I came to an agreement to take him off all other work in order to give me a private course of fossil conchology, in which he is to give me all his time for a month, towards the zoological part of Vol. 2, also to give me two months' additional work when I am gone, providing me with the results derivable from his great collection and that of others at Paris, relating to the newer formations, which he intends to publish in a Manual of Conchology a year and a half hence. I shall thus be giving the subject a decided push, by rendering the greater wealth of the French collectors available in illustrating the greater experience of the English geologists in actual observation, for here they sit still, and buy shells, and work indoors, as much as we travel. I am nearly sure now that my grand theory of temperature will carry the day, and at least I have had the satisfaction hitherto of finding no one dispute its entire novelty. I will treat our geologists with a theory for the newer deposits in next vol., which, although not half so original, will perhaps surprise them more. I am prepared to hear from Murray that the political hubbub has injured the sale, for all the Natural History and Medical booksellers here declare they shall be ruined; they are literally reduced to sticking up political pamphlets in their windows.

October 3.—A *soirée* at Baron Férussac's last night. Instead of natural history, he was full of an approaching election contest, for a place for which he is to stand in the south. He got in by three votes as a Charles X. man, a short time ago, but now he has hoisted the tricolor flag. I shall have to work for three weeks or more here, and shall be glad to hear from you. The best geologists are not yet returned from their summer campaign to Paris. One of ours, Weaver, is here. Great disappointment among the officers to-day, because the Prussian invasion of Belgium is contradicted.

With love to all, believe me yours affectionately,

CHARLES LYELL.

To POULETT SCROPE, ESQ.

Hôtel du Rhône, Rue de Grenelle—St. Honoré, Paris: October 8, 1830.

My dear Scrope,—I must not delay any more writing for fear you should put off your proposed expedition to the sea-coast, in expectation of my joining you, which I shall be unable to do, although nothing would really be to me so great a treat. I must, however, be satisfied to run one hare at a time, and I am flying at high game just now. I am going through a course of fossil conchology, particularly with a view of satisfying myself as to the identification either of recent with fossil tertiary species or of those of different basins with each other; and I am having, at considerable expense, tables made out of more than 3,000 species of tertiary shells in the collection of Deshayes and others in Paris, of which the localities are well determined, and have been almost all visited by myself. The results are already wonderful as confirming the successive formation of different basins, and the gradual approximation of the present order of things, and will settle, I hope for ever, the question whether species come in all at a batch, or are always going out and coming in. A multitude of other surprising conclusions arise, and the harmony of the whole with the phenomena of earthquakes and volcanos, of geological super-position, of the position of land-quadrupeds (fossil), of contents of fresh-water lake formations, &c., is very beautiful. I am too busy to enter into the ripple theory. Prévost has been working at it here, for in the Calcaire-grossier it is a common phenomenon. He thinks with you it is connected with undulations of inferior currents, &c.

Make experiments on waves in an estuary. It is to me a most puzzling phenomenon. The wind was blowing up the Gironde one day, and as I thought the waves rolling up, although the tide ran down several miles an hour. I threw some pieces of paper into the river (we were at anchor), and was astonished to see them first fly out of my hand to the south, or up the stream carried by wind; but instantly on touching the water float down very swiftly, passing over the waves as if there were no wind against them. At last the

wind got up so as to make the waves curl over and break in foam upon themselves. Of course, when pieces of paper came to one of these breakers the falling wave stopped it for a moment, but the instant afterwards it was seen far below, floating on the superficial water. It was clear, then, that the waves were tidal waves; and I then remarked that on them there was ripple which the wind caused. This small ripple was all the wind could raise. Now on watching this ripple I saw it often remain quite abreast of me, the great waves passing down, just as a person in a long barge going down a canal might keep close to you as you stood on the bank, by running from the prow to the stern at the same rate as the barge was carried down. Here I apprehend was a complete equilibrium in part of the upper stratum, while the ripple retained its place. I found just within the mouth of the Gironde, in the sands at low water, a large tract with a beautiful double ripple-mark, a larger one parallel to the shore, and the other at right angles, consisting of small ones. The great ridges were 5 inches or so high, the smaller ones 1½ about. They were like a plan in relief of longitudinal and lateral valleys in a mountain-chain; but the summit of the larger and higher ridges had not been disturbed by the cause which added the lateral ones. I am afraid I shall not be intelligible without a longer letter.

Deshayes has found at St. Mihiel, south of Verdun on the Meuse, not far from where you mention, and in that same deep valley, four old needles of limestone like those of chalk in the Isle of Wight, one called the Devil's Table (do you remember?); they are composed of old remnants of the white crystalline limestone of highly inclined strata. They have three distinct *horizontal* lines of perforations like the columns of the Temple of Serapis, the hollows, sometimes empty, but *thousands* of them filled with the saxicavas, *now*. He has shown us some; they go *all* round the Needles. The same are seen on the neighbouring precipice at similar heights. The shells get petrified *in situ*, and so are imperishable; species cannot be determined. You will at once draw all the consequences. All that the *river* has done, is at best up to the highest mark of the alluvion. And here, in the middle of the continent, at such an elevation, we have

preserved the sides of an old frith, and proofs of the successive rise of the old rocks out of the sea, for they are worn by the wind and water mark at the three places perforated.

Believe me, ever most truly yours,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

Paris: October 10, 1830.

My dear Friend,—I find from Pentland you have had the disagreeable job of dunning Deshayes again. The Sieur D., as Murchison calls him, is undoubtedly one of the most 'imperturbable' characters in these respects I have met with, nor can I defend his conduct in this, and some other small matters. It does not, however, arise from anything dishonourable in his conduct or intentions. He was, you must know, for ten years a medical man, in considerable practice for a beginner, in one of the unhealthy and therefore not well (or wealthy) inhabited quarters. He had about fifteen patients a day, who kept him constantly at work, and never paid. At last he determined to cut the affair, and try to live on natural history, which, although his passion, he had abandoned. He has earned his bread with great difficulty by writing for encyclopædias, &c., and spent every sixpence on very expensive works, on fossils and recent conchology, between 30*l.* and 40*l.* worth, and on shells. Just as I obtained the crag shells from you and Taylor, Rozet, who has published a small work on Geology of no originality or value whatever, engaged him for five hundred francs to write a small conchological appendix, and this entirely prevented his doing anything for me. Had I known his situation, it would not have happened, but to tell the truth, his bearing was so independent, that I should as soon thought of asking Broderip to name my shells for *argent comptant* as Deshayes. Now I am better informed, I see that he is not justified in giving me a day without pay, for he has sacrificed his existence to make himself, for the benefit of science, the first fossil conchologist in Europe. I have now engaged three months of his time, to enable him to teach me conchology, and to construct

tables, which I have planned for my second volume of tertiary shells, and to name all my Pyrenean specimens, &c. At the same time, I am enabling him to cut inferior work, and to use the same materials for a Manual of Conchology. It will make a deep cut into the small sum which Murray is to pay me for vol. ii., and will indeed consume all which the amanuensis and the extraordinary expenses had not eaten up, but I find already that it will pay me in the satisfaction of giving an essential push to our favourite science. Already the results of Deshayes' collection are yielding fruits unexpected by himself, and very confirmatory of the order of succession of tertiary formations which I had arrived at, from purely geological observations. The crag though probably older than almost all the tertiary formations of Sicily, is still a formation containing a decided preponderance of living species, and between it and the London clay you will see how magnificent a series of events I will describe. As your fossils could not be properly compared till we come to those genera, for I am going through the whole comparing with Deshayes, you must still let us keep them a little, but I will not leave Paris without them. Cuvier last night spoke with great pleasure of having made your acquaintance, and hopes you will visit Paris. He is not in spirits about political affairs, and consequently I got him for the first time to talk about fossil anatomy freely. Remember I have heard no geological news for three months, save the dinner to Cuvier, and a note from Murchison saying that Conybeare had fired a shot at me in 'Annals of Phil.' What is that about? Politics absorb all the thoughts of geologists here. There are croakers enough about the state of France, but I see no ground for it, and I believe if left to themselves they will get on. To do without some odious taxes, with an increased army, and with commercial bankruptcies innumerable, is the difficulty for the moment.

Ever most truly yours,

CHARLES LYELL.

To His Sister.

Paris : October 19, 1830.

My dear Caroline,—I must stay here a week or two more in order to make myself fully master of the details from which my great tables of shells are to be drawn up. I have gone through a great part of Deshayes' collection systematically, following Lamarck. I had no idea that shells so studied could be so interesting, or that the arrangement was so philosophical, being founded on the *animals* which inhabit the shells. With an immense collection before you of recent and fossil shells (35,000 individuals and 8,500 species), all well arranged in their natural groups, and with a clever conchologist at your elbow, you may in a short time make yourself master of more than I ever expected to know. I am determined to begin a collection in earnest, having already a fine start in all my Italian and Sicilian shells now named, and in eight hundred named fossil species, which I have bought of Deshayes. No one in England has an idea of the results to be obtained from a good collection of fossils, or the value and accuracy of these medals when well collected, but I trust in my next volume to make them know it. This morning all my Etna shells were examined ; out of sixty-three only three species not known to inhabit the Mediterranean, yet the whole volcano nearly is subsequent to them, and rests on them. They lived on a moderate computation 100,000 years ago, and after so many generations are quite unchanged in form. It must therefore have required a good time for Ourang-Outangs to become men on Lamarckian principles.

The night before last we were alarmed here by a mob, not for ourselves, but for the inmates of the Palais Royal, because they were quite unprepared, and the guard weak. The people think, as John Bull would have done under similar circumstances, that the proposal to abolish the punishment of death is prejudging the case of the ex-ministers, and many moderate *bourgeois* even are become violent against what they call a *ruse*. The lower class, who suffered most in the fight, look on the ex-ministers as their prisoners

of war, and are exasperated at the notion of their escaping scot-free. So they came as they say, to serenade 'Le citoyen Philippe, propriétaire, No. 200, Rue St.-Honoré.' Several thousand of them sung the Marseillaise and Parisienne alternately, with such energy, that when two diligences came down our narrow street, and when we should hardly have heard a musket under the window, we heard every note. Anything but cannon would have been drowned. It was like the roar of several tempests bellowing in correct time. There was a ferocity in it that was more horrid than anything I ever could have conceived, yet we were six times the distance of the king's rooms. After keeping up this for three or four hours, there was a call of 'Vincennes,' the prison where the ex-ministers are. Instantly they all went off, rushing up all the side streets from the Rue St. Honoré so fast, that we thought the cavalry were charging. Luckily the general at Vincennes was prepared for them, and they could do nothing. At half past two o'clock they returned here, and sung again. The first shout awoke us all like a clap of thunder in the dead of night. Since that, all is quiet, the national guard can be relied on, and are 80,000 strong. The king was a good deal alarmed, but acted with spirit and prudence, and no one fears now, and a reaction in favour of the king has been produced. A small mob last night, who collected there, went away cheering him, upon his coming out on foot, and saying 'that they should have *justice*, but not *vengeance*.'

With my love to all, believe me, your affectionate brother,

CHARLES LYELL.

To G. POULETT SCROPE, ESQ., *Castle Combe, Chippenham.*

9 Crown Office Row, London: November 9, 1830.

My dear Scrope,—I received several letters in Paris before I read your article congratulating me upon having fallen in with a critic who was capable of handling the subject in an able manner, 'and in whose review a friend's spirit pervaded the whole, though he finds objections to those parts most generally controverted.' Among others, I was delighted at Murchison having been taken in, and attribut-

ing it to Sedgwick, whom he had not then seen on his return. Perhaps you know that he idolises even more than the Cantabs 'the first of men,' as Adam is usually styled there, and although he really has talent enough to appreciate most fully the merits of a good thing when he reads it, yet the eulogy was somewhat more from the soul than might have been poured forth on one younger than himself, and who was neither entitled as president or Professor to show him the way. Murray, among others, wrote to say that the sale of the first three months before the 'Quarterly Review' appeared was 650 copies, and he had no doubt that an article acknowledged 'to be at once *masterly* and *popular*,' would soon help them to dispose of many more. For myself, I assure you without reserve, that I am quite sure of, what I am sure will be the universal opinion, that it is incomparably the best thing you ever wrote, and in point of style as well as originality, a great stride beyond any former composition on a scientific subject. I include those parts where you oppose me, even when I still differ very considerably. The suggestion that the Mediterranean would sink if separated from the ocean, is so self-evident when stated, yet so new, and opens such magnificent views, and explains so much, that it would have redeemed fifty pages of prosing. The explanation, which I had endeavoured to hit off in vain, of the sandbanks opposite the indentations in river channels, is so clear, that like most discoveries, all will wonder how they missed it. It is your own I conclude *the attributing it to the momentum*. These hints will enable me greatly to improve my second edition if I have one, as is expected. Such a broad-side will do far more than my book to sink the diluvialists, and in short all the theological sophists. Conybeare I am told has published in the 'Annals' 'an explosion' against me. I shall not answer it, but thank heaven he cannot turn the battery of the 'Quarterly Review' against me now. Basil Hall at the first meeting of the Geographical last night, which I just cut into from the Dover coach, said to me, 'Well, I will tell you fairly, I did not think you could have written such a book.' And so, I know, almost all of our council will say of your article, but neither I nor Lockhart are of that mind, and I am gratified that you have by an anonymous article

surprised many with an admission of your capability of doing what I have frequently endeavoured in vain to assert you might do, when regretting that you had cut in some measure science, for political pamphlets.

Murray ought to send you 70*l.* for the good you have done the review,[2] to say nothing of probable aid to his book. I am going on now with vol. ii. It would sell, even if stupid (which it shall not be), so great is the excitement for and against, which vol. i. and your article have together caused. I am in all the mess of unpacking, so must conclude, and with kind remembrance to Mrs. Scrope, believe me ever most truly yours,

CHARLES LYELL.

To DR. FLEMING.

9 Crown Office Row, Temple, London : November 12, 1830.

Dear Dr. Fleming,—I am just returned from Paris, where I spent five weeks, steadily applying myself to the study of recent and fossil conchology, in the rooms of M. Deshayes, whose collection contains 8,000. Although I have thus late entered in earnest on this branch, I hope some years hence to possess as fine a collection, and perhaps as much information respecting it as any one here ; and I am building a cabinet and have purchased considerably in good tertiary shells. It might perhaps be agreeable to you, as it would be most serviceable to me, to exchange duplicates of French tertiaries for carboniferous fossils, and might induce you to collect these zealously. I shall always be ready to send you what you may wish in return in this way, as I know no point where so much has been done in this, as by you in Fife. Your letter on my book was very kind, and at a time when in Paris, I could find no one whose mind was not occupied with politics, and when I had received no news of the progress my book was making, it was most consoling. Every one agrees with you that the size of the volume and the type has been much against it, and Murray is of that opinion too. But as your friendly anticipations have been already realised, I shall be able to correct this, in a second edition,

[2] Note by Mr. Scrope : 'He gave me 100*l.*'—G. P. S.

at no distant period. It seems that, for the first three months, they sold fifty copies a week, and since that I have heard no bulletin, except that the demand is constant. Murray declared, that if I could give him vol. ii. in six months, before half the purchasers of the first had either forgotten it, lost it, gone abroad, died, &c., he was convinced that in twelve months from the present time not a single copy of either volume would be unsold. With this encouragement I shall be glad to persevere, and benefit by any criticisms either in letters or in print, which you or others may come out with.

It would be doing me a service, now that I am obliged to spend money on secondary fossils with hard-dealing merchants, if you would exchange them against books which you may want; a proposition so common in France, and I think so fair between naturalists, who must make sacrifices, in order to form their libraries, that I propose it, *sans cérémonie*, and it might justify you in seeking more keenly for Fife shells and corals, than you would otherwise feel disposed to do. Believe me, ever truly yours,

CHARLES LYELL.

To HIS SISTER.

London: November 14, 1830.

My dear Marianne,—I have pretty good news to tell you about my volumes. . . . The booksellers assure me that if the latter part of my work is as popular and readable as the first, it will prove an annuity to me. Whewell of Cambridge has done me no small service by giving out at his University that I have discovered a new set of powers in Nature which might be termed 'Geological Dynamics.' He is head tutor at Trinity, and has more influence than any individual, unless it be Sedgwick. The young baronet[3] who franks this says that my new theory of deriving salt from inland seas, like the Mediterranean, went the round of the newspapers in his county (Cheshire) with great applause, as they felt a local interest in the explanation. He himself swears by it. He is very fond of conchology, and promises to send me

[3] Sir Phillip de Malpas Grey Egerton.

immediately a complete set of the N. of England freshwater shells. I have fixed on new rooms in Raymond Buildings, Gray's Inn; very light, healthy, and good. I suppose in ten days I shall have shifted quarters.

I shall send you soon some exceedingly entertaining German books, and hope when you find them likely to be useful, and make some progress, we may read them together in the spring, as soon as I have got rid of vol. ii. Lieutenant Graves is arrived, and has, at this most opportune moment, brought me several boxes of shells from S. America. I shall be in a bustle for ten days I fear, getting into my new rooms. They are on the same staircase as Broderip, whose library and great collection of recent shells, worth some thousand pounds, will enable me to dispense with laying out money, some of which would have been necessary otherwise. I shall also be very near Stokes. Brown the botanist has just given me some good information about a mummified Egyptian plant, and I am going to get a wood-cut executed. Several friends have asked me to dine out, and as I see I must make a firm stand, I have refused all, and shall only go to a club dinner once a week. There is scarcely any steering a middle course. All my friends who are in practice, do this all the year, and every year, and I do not see why I should not be privileged, now that I have a moral certainty of earning a small but honourable independence, if I labour as hard for the next ten years as during the last three. I never was in better health, rarely so good, and after so long a fallow, I feel that a good crop will be yielded, and that I am in good train for composition. How I wish we could be fellow-labourers! Yesterday Milman the poet, whom I scarcely know, sent me a long and curious extract from a German book about some theory of the followers of Zoroaster, to help me for the second edition. I have sent for a translation from the Miss Somervilles. If you were near this smoky hole, which after my late stay in Paris, appears dirtier than ever, I would gratify your desire to be useful to its full extent, but since we are both pinned like shrubs to the spots we are planted in, we must be satisfied. I think I may be out in six months, poz; Murray says five, but that I cannot. I am very confident that the matter in

vol. ii. will be more generally popular than in vol. i. if I succeed in making as much of it as I see it admits of. I shall only go to the end of the tertiary period. It will include the history of the globe as far back as the time when the first of the existing species came in. If I have succeeded so well with inanimate matter, surely I shall make a lively thing when I have chiefly to talk of living beings!

I shall send the shuttlecocks and battledores, but don't quite wear them out in the winter, as I may be with you before out-door exercise is always within reach, if your account of ordinary springs be true.

With love to all, your affectionate brother,

CHARLES LYELL.

CHAPTER XIII.

FEBRUARY–SEPTEMBER, 1831.

APPOINTED PROFESSOR OF GEOLOGY AT KING'S COLLEGE—VISIT TO CAMBRIDGE—JOURNAL TO MISS HORNER—MRS. SOMERVILLE'S 'MECHANISM OF THE HEAVENS'—PARTY SPIRIT ON THE REFORM BILL—ON EDUCATION OF BOYS—MADAME DE STAËL AND HER WRITINGS—SIR WILLIAM NAPIER GOES TO SCOTLAND—EDINBURGH—LORD COCKBURN—DR. GREVILLE—KINNORDY.

[Mr. Lyell made a tour of some weeks during the summer of 1831 to the Eifel, a volcanic district between the Rhine and Moselle rivers.

He was appointed Professor of Geology in King's College, London, and gave a course of lectures in 1832 and 1833. After which, finding that the duties would interfere with his schemes of travelling and original research, he resigned the office.

He was appointed Deputy-Lieutenant of the County of Forfar in 1831.]

CORRESPONDENCE.

To Dr. Fleming.

2 Raymond Buildings, Gray's Inn: February 7, 1831.

My dear Dr. Fleming,—I hope you are proceeding successfully with your volume on organic remains, of which, now that I am writing on the secondary strata, I should be very glad. If you were printing it I should crave a sight of the sheets done, in order that I might benefit. We expect you will throw much light on the organic remains of the carboniferous era. I am finishing the last two chapters of a somewhat longer volume than that of which you have, I hope, received a copy from Kinnordy, and I mean to lecture from the slips, as far as that can be done, having magnified all the sections a hundredfold, which are to adorn my book,

for the lecture-room. If the course of twelve lectures should prevent my being out with the volume before my marriage, in other words, before a year or more, I shall sadly regret having accepted of the chair. But I hope to do both. The King's College is coming on gradually, the number of students having augmented by more than one-third, both in the junior and senior departments since Christmas, and promising to increase again in the same ratio at Easter next. Sedgwick wishes to make your fish scales a means of identifying his Caithness schists, and all their fish and the trionyx, with a member of the lowest 'old red.' I am sure I have no *objection*, for I would as lief start with vertebrated animals and freshwater, as with a universal ocean, and the simplest forms of animal life. Only I require rather more proof for identification than the Welsh Captain did, when he made out that his hero and Philip of Macedon were the same, 'for there is a river at Monmouth, and likewise also there is a river in Macedon, and there is salmon in both.' If the *species* of salmon and of plants could be proved to be 'as like as my fingers to my fingers,' then I think it would do well enough. In one of your last letters you mention having reptiles from the carboniferous era in Scotland—this is delightful news to me. I expect to prove that there are three distinct mammifers in Stonesfield slate. Vernon admits that his single saurian vertebra was only in alluvium, but that alluvium entirely composed of mountain limestone.

Ever most truly yours,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

March, 1831.

My dear Mantell,—I have been within this last week talked of and invited to be professor of geology at King's College, an appointment in the hands entirely of the Bishop of London, Archbishop of Canterbury, Bishop of Llandaff, and two strictly orthodox doctors, D'Oyley and Lonsdale. Llandaff alone demurred, but as Conybeare sent him (volunteered) a declaration most warm and cordial in favour of me, as safe and orthodox, he must give in, or be in a minority of one. The prelates declared 'that they considered some of

my doctrines startling enough, but could not find that they were come by otherwise than in a straightforward manner, and (as *I* appeared to think) logically deducible from the facts, so that whether the facts were true or not, or my conclusions logical or otherwise, there was no reason to infer that I had made my theory from any hostile feeling towards revelation.' Such were nearly their words, yet Featherstonhaugh tells Murchison in a letter, that in the United States he should hardly dare in a review to approve of my doctrines, such a storm would the orthodox raise against him! So much for toleration of Church Establishment and no Church Establishment countries. It is, however, merely a proof of the comparative degree of scientific knowledge diffused. Pray be so kind as to give me the earthquakes. A shock in Sicily which threw down Melazzo, seems to have occurred nearly on, if not on the same day as Dover. Another just announced in China has killed, they say, a million of men, all in favour of modern causes;—it is an ill wind, &c. The young Prince George of Cumberland told me the other day of you and the great lizard, which last has taken much hold of his imagination. 'Tis clear, as Abernethy said, you will ride on that beast. Don't throw away any great big specimens, for if I lecture, I shall be as greedy for them as I have hitherto been shy of them. I will get a scene-painter to put Etna and Auvergne on scenes as large as in a theatre, on canvas, from Scrope's and my sketches. Scrope writes, 'If the news be true, and your opinions are to be taken at once into the bosom of the Church, instead of contending against that party for half a century, then, indeed, shall we make a step at once of fifty years in the science—in such a miracle will I believe when I see it performed.'

Ever yours,

CHARLES LYELL.

To HIS SISTER.

London: April 7, 1831.

My dear Marianne,—I almost forget where you are in regard to my affair of *the chair*, but I think I said I had indited an epistle to Bishop Copleston (the minority of

one) to tell him among other pleasant news, that I meant to do my best to show in volume ii. that no deluge has swamped Europe within 4,000 (I might have said 40,000) years. On his other points I was fully agreed with him, and on this I told him I had no objection to his drowning as many people as he pleased on such parts as can be shown to have been inhabited in the days of Noah. In his answer he thanked me for my candid statement. Although some of my friends assure me I shall lose by this concern, I do not; and most of them agree with me that it places a man who wishes to devote himself steadily to a branch of a science, in a much more agreeable, influential, and respectable situation, and it is not like taking orders, a step without a retreat.

Conybeare has taken his last shot at me. Daubeny has fired off one at me, in a timid sort of a discharge, and full of puffs about 'Oxford being proud of me, though I am not of the Oxford school of Geology.' Sedgwick's attack is the severest, and I shall put forth my strength against him in volume ii.

Your affectionate brother,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

Athenæum, London: June 22, 1831.

My dear Mantell,—I take the largest sheet I see near me at the Athenæum to write an apology for my remissness. A visit to Cambridge of a week with Buckland, Conybeare, Daubeny, and other Oxonians, who were returning a visit which the Cantabs made to them, was the first cause of silence.

We were lionised with a vengeance—lectures, experiments (optics, polarisation), feasting, geologising, and evening-party going, and nocturnal smoking and cigars, and by way of *finale*, Conybeare and I took our *ad eundem* degrees, and were admitted M.A.s of Cambridge. Then came an arrear of work here, and my father and brother in turn gave me lots of interruption, notwithstanding all which, as also much lionising of Conybeare, who wanted to be introduced to divers persons, I have reached p. 110 of printing volume ii.

The four great slabs are two of them worth nothing, but the other two are as magnificent specimens of the forms of ripple as I ever saw. Many thanks. Murchison and his wife are gone to make a tour in Wales, where a certain Trimmer has found near Snowdon 'crag' shells at the height of 1,000 feet, which Buckland and he convey thither by the deluge.

You heard of Fitton's accident? Changing his residence as usual; going from his country seat near Sevenoaks to a new place eleven miles north of town, taking a maid-servant to Harley Street in a gig, horse ran away in Regent's Park, dashed against a gate. Fitton's arm said to be broken high up, but Brodie can't make out where; feared that the blade-bone was injured, but hopes not, as Dr. F. is doing so well. Lonsdale says that the great femur of which Trotter has given us a cast, was of an animal that had paddles. What is the largest paddle-bone you have? No room to talk of age of reptiles.

Ever most truly yours,

CHARLES LYELL.

JOURNAL.

[Extracts from letters and journal to Miss Horner, eldest daughter of Mr. Leonard Horner, to whom he was engaged, and who was with her family at Bonn on the Rhine.]

Rotterdam: August 4, 1831.

My dearest Mary,—I tried, as soon as the steamer passed Bonn, to compose my thoughts by steadily reading Macculloch's vol. ii., and succeeded tolerably, till I landed at Cologne, and then walked to the Cathedral. It was eleven years since I had been in it, with my father, on our way to Italy. I remember well the splendid painted windows, and that singular semicircular aisle behind the altar. Although there is no such architecture in Italy, this gigantic fragment of a church reminds me of Italy. There is nothing there so striking as the innumerable monuments of the designs of architects and priests, which outran all reasonable

calculation of means. It is rare to see an Italian church finished. But I suppose if Catholicism had remained in full force five centuries more, Cologne would have been finished, for the secret of our own grand gothic buildings having been finished, was their having been added to, during many successive centuries, by 'corporations that never died.' After I had left the Cathedral I heard a bell begin to toll, the finest sound I thought I had ever heard. I returned, and found about sixteen men or more pulling at one rope in the great tower, or to as many strings attached to one main rope. This huge bell, they told me, was only rung on a few occasions in the course of the year, not on Sundays and ordinary *fête* days. This was the eve of the King's birthday. They say it is the finest bell in Germany. I was never so much struck with any, even at Rome. I waited a quarter of an hour to hear it in the great tower, 'swinging slow with sullen roar,' and then tried to find my way to the town hall, but lost it; fortunately, for I blundered on a street where I saw a mark in a stone of a great flood of the Rhine in February 7, 1784, when its waters were seven or eight feet higher than they have ever been since. I cannot understand this, since in February there could not have been a great melting of Alpine snows, but that for half a century since, nothing like such a flood has occurred, is a good fact; the effects of *rare* combinations of the most ordinary causes, are scarcely ever reckoned upon enough in geology, and I could preach for a page on this text, if I did not fear I should put you to sleep. We have had to-day the certain news of the Prince of Orange having entered the Antwerp territory, and so many stories of that city having been attacked, that I fear something must have happened. As the Dutch have the best organised army, and are more united, I think they do well to show a little spirit, and unless a general war comes on, they will get better terms by it. Here the war is popular, and the going out and return home of the regiment quartered here, to exercise, is quite a triumphal procession, morning and evening. Tell your mother, with my love, if she finds her thoughts fatigue her, I recommend her to read, if she can get it, Madame de Staël's chapter on the efficacy of study in such

cases to calm the mind. It is in her work, 'L'Influence des Passions sur le Bonheur des Nations et des Individus,' one of the most splendid productions of the age. The sun has just made an effort to break through the clouds, so we shall have no rain I think.

August 7.—Sent my Rotterdam-arranged MS. to feed the hungry devils, and corrected a sheet and a half of text, of that set up in my absence, the fruit of three hours' hard, steady work, aided by my steam-engine Hall, for in this stage of the business more than half of the work is mechanical. I hope to receive from the binder my old copy of the work of De Staël, of which I spoke, that you may have it. Be careful not to erase my marks. I shall re-read it with delight; it is the work of a mind which had been agitated strongly by almost every passion, which had felt intensely, and therefore wrote eloquently—her rules and precepts are often inexplicable to ordinary affairs and common minds, but it is a splendid production. I recollect the chapter on study (though I have forgotten its details) made a lasting impression on me, and taught me among other things to take delight when engaged in composition, in improving, enriching, and embellishing thoughts, instead of deeming that drudgery; just as an artist retouches a painting. My copy of De Staël is just returned; I have been dipping into it. It is the more striking as being so exaggerated. The balance against the chances of happiness in many of the most natural and best passions, is not so unfavourable as she paints it, but such would the world be, if all were as romantic, sensitive, and imaginative as she was.

August 11.—Went to Paganini's concert, Prandi having sent me a ticket. Paganini can play both beautifully and wonderfully, but I would rather have half an opera another time, than all his performance.

August 12.—Boué, the French geologist, called, just arrived with his wife from Paris. Am to see him again to-morrow, and to show him my Sicilian volcanic specimens. At Athenæum saw with pleasure that the Dutch had routed the Belgians.

August 13.—Before I go to rest, a few words of a day of

steady work, and few incidents—wrote to Mantell, dispatched nearly half the printed Tables to Deshayes—walked over the rooms at King's College, which promise to be handsome and well lighted. Found the table of Athenæum this evening covered with new books—in this respect a club is a real economy—Whately's new lectures on Political Economy. In the first of those which I skimmed, is a long combat against those who object to the Rev. Professor's science, as opposed to the Bible. He says that the cry is louder 'than against geology,' because people will admit that the sacred writings were not to teach us *physics*, but say that a science connected with *human* concerns should be in accordance even with the letter.

August 14.—Webster brought the corrected drawing from my sketch of the Val del Bove on Etna, one of the grandest scenes in Europe. Although a poor representation, it will give some idea, and be useful geologically; I shall go to Chelsea, and hope to find the Somervilles.[1] Arrived at five o'clock, and found that dinner was at seven: was lucky enough to find Mrs. Somerville in the garden, told her of my expedition to Eifel, &c. She showed me her volume,[2] all done save the index. The preliminary discourse will be popular, dedicated to Lord Brougham, as he suggested it; no word of flattery to him. The Murchisons have been staying with the Conybeares in Wales, which country, said Dr. Somerville, 'they have now done.'

August 16.—Mrs. Somerville said yesterday that she never knew politics in London so embitter people as in this Reform Bill: the fact is there never were such private interests at stake before. Few bills for the confiscation of property ever passed in any country which smote individuals so hard. When a man has several brace of borough appoint-

[1] Mrs. Somerville, b. 1780, d. 1872. Author of *Mechanism of the Heavens*, from La Place; *Connection of the Physical Sciences*, *Physical Geography*, &c.

[2] *Mechanism of the Heavens.* 'Mrs. Somerville's volume is ready all but the index. The preliminary discourse into which I dipped will be popular and of high interest; it touches on all the grandest subjects. Speculations, for example, on cavernous structure of the interior of the earth; what the total number of comets may be; what the climate of other planets, and in which of them our plants, &c., could live. How the sun and other bodies look from each of them, and an immense variety of other topics.'—Extract of letter from Mr. Lyell to his father, August 15, 1831.

ments, each worth forty or fifty thousand pounds in the market a year ago, he may well cry out, and may easily persuade himself that the good derivable to the country is problematical. The Liberals say that the cutting up counties will make each district a close borough, and so a new aristocratical influence, as bad as the old, will arise. I doubt whether it will be as bad, but the new House will be aristocratical enough. A letter from my mother to-day announces her recovery. She is going up to the hills, to a shooting quarter of ours. Some day or other, we will go up to that shieling in the midst of the heather, where there is a fine air, and where many a time I have enjoyed the glorious view of the Grampians on one side, and on the other of Strathmore and its lakes, with the Sidlaws and the Lomonds of Fife in the distance. Although the game was scarce, I used to like it better than Lord Airlie's preserves, as he has no scenery, though thirty brace for one bird on our ground.

August 17.—The best day's work, at least the greatest number of hours at composition since Rotterdam—it will require a multitude more, before I have done this volume. The facts which are given in a few sentences, require weeks of reading to obtain. A letter from my aunt Heathcote, one of the most amiable creatures in existence, and moreover an elegant style of person, inviting me to pay her a visit. How lucky that the very day I got it, she must have received mine to say I meant to come! Lonsdale has just told me that one of the principal reviews, as he heard from Fitton, has just held up Sedgwick's speech, and my first volume, as models of style for all English scientific writers. I must learn where this is, for as Messieurs les Critiques give one some hard rubs, it is fair to seek out their commendations. It is a reward for doing a thing with care. Did not Miss Parker[3] remark that the gravel of the Rotherberg was as free from scoriæ and volcanic rocks as that above Friesdorf? What are volcanic rocks? she would say. I answer, Any of those which the said Rotherberg in general, or Rolandseck, are made of. Webster tells me, he spends all his time in

[3] For seven years the valued friend and governess in Mr. Horner's family.

teaching ladies geology, and remarks that they have more liberal curiosity about science than young men. The fact is our boys are worse educated now than girls; they spend ten years and more at school and college, in learning Latin and Greek; two weapons which nine out of ten never use. They are mere linguists of dead tongues—they get *learning* without *knowledge*, and without the taste of acquiring a knowledge of things. A system which would make our youths not scholars, but lovers of knowledge, would be a grand reform. It would be easy, for it is natural in youth to love it.

August 23.—Made good progress in my MS. I forget whether I told you that Mrs. Somerville's book was shown me in boards, but without the index, at least a hundred pages longer than my first volume, and about the same dimensions in other respects. Mine even was deemed too corpulent, as well as having too much crowded into a page, which in the second volume we mean to correct, though using the same type. About 500 pages of Mrs. S. is algebraic, x, y, z, and sealed save to those deeply initiated. The introductory hundred will be popular, and I trust serve as sails and winds to waft the heavy cargo on through these unpromising times. While I was working here at four o'clock Lord Northampton came in, and sat cozing three quarters of an hour, about fossil insects, shells, and how he should vote on the Reform Bill. After supporting second reading he is to go to Rome, and *not* leave his proxy. 'They will alter it so that I cannot say what the third reading will be, and I am not a thick and thin man that can trust another with my vote.' I have just received your letter. Do not suppose that my marks of Madame de Staël's sentiments are always of approbation—they are like the hear, hear, of M.P.s of something which strikes, often as true, often untrue, or doubtful. I look upon her as a phenomenon—a giantess almost rivalling any male giant of her age. Her imagination was vivid and poetic, and tempered by judgment, and she had a philosophical mind also. Had she written first-rate poetry, she would have shown that the very best power of mind which can be developed in man may belong to her sex—which nevertheless would be unfair, since they have many

excellences which men cannot have. I think her work the more interesting, as showing how a powerful mind, placed under the circumstances that a woman's must be, would think and write. Hereafter her writings will stand out in relief more prominently, among those of her contemporaries, than they do now; very few as boldly, and this is saying much, when the general standard is so high, and so many minds are highly cultivated. But when an equally great vigour of genius is given to some woman, who has more of the perfect qualities, the peculiar attributes of her sex, we shall have something more splendid and characteristic and original. Like most great characters, she was a mixture of good and bad. From much that I have heard of her, I can believe her speech about her daughter, that she was *bête comme son père*, although her husband was much above par, and if he had not been, she would have fancied it, had she been amiable. But her extravagant admiration of her father, whom she overrated, in a great degree from filial feeling, was a redeeming quality—as regards feeling, what in this case overpowered her better judgment. Had our friend Mrs. Somerville been married to La Place, or some mathematician, we should never have heard of her work. She would have merged it in her husband's, and passed it off as his. Not so De Staël, she would have been a jealous rival. What she says of Nature never having given great talents, without accompanying the gift with a love of displaying them—a desire to make them tell—is most true, but much that she says of the incompatibility of even moderate ambition and love, is false and curious only, as showing that she had found her desire of fame to be that of one placed in a false position. A man may desire fame, reputation, and even glory, for the sake of sharing it with one he loves. A woman cannot share it with her husband, it will be the utmost she can do not to make him of less importance by it. I am sure that it is very common in ambitious men to look upon whatever they acquire, whether of fortune or fame, as chiefly valuable for the sake of others. I could, and should feel this; for a wife, children, brothers and sisters, that the *sharing* it, constituted its chief and almost only value—that the mere personal aggrandisement was of itself a shallow

pleasure. As for love being an episode, &c., it is true both to man and woman in the sense of that romantic sort of love which the Authoress of 'Corinne' would try to persuade herself should run through life, but what never could nor ought to do, or to be more than an episode in any person's life—but speaking of love in a more sober sense, I do not believe it, and could point out proofs of the contrary.

To reap the full benefit of what the Germans are doing and thinking would require no moderate intimacy with the tongue, and its idioms. I am sure you will work at it with more zeal if you believe you can help me by it, as I labour with greater spirit, now that I regard myself as employed for you as well as for myself. Not that I am at all sanguine about the pecuniary profits that I shall ever reap, but I feel that if I could have fair play for the next ten years, I could gain a reputation that would make a moderate income for the latter part of my life, yield me a command of society, and a respect that would entitle me to rest a little on my oars, and enable me to help somewhat those I love. I met Smith, F.R.S., to-day, coming to ask me to join Wallich the botanist and Sir Robert Inglis at R.S. club dinner. Smith poured out, 'I am in the middle, and full of astonishment and admiration at your having, among other things, been the first to take the bull by the horns, about the antiquity of the Earth, and contrived to do it in so inoffensive a way,' &c.

August 26.—The Chevalier Ricasoli came in to receive the second packet of Tables, which he is to take to Deshayes to Paris. He caught sight of my plate, intended for a frontispiece,—from a sketch of my own, a view in Catalonia in Spain, the volcanos of Olot. Prandi[4] was delighted. 'Ah! that is Olot indeed. Well I fought there for thirteen days, five were we encamped on that hill by that church; and so the hollow was the crater, and the cone a volcano. How odd, I never dreamt of that! at its foot we killed 400 of the *factions*! but from that hill (another volcano), as we passed to enter that valley, a discharge of shot thinned our ranks. We could not return it with any effect, we were on that flat plain, and on the slant of the cone, concealed in the vines.

[4] An Italian refugee, who resided many years in London.

There is the defile, through which Milano brought his troops from Gerona, and this is Olot, with its villanous population, of 30,000, all factions.' 'What do you mean by *factions*?' 'Why those were the times of the established constitution, they were rebels, *now* the legitimates.'

August 27.—An hour and a half good work before breakfast, ditto after, then Hall reading De la Bêche, while I shaved, half hour's recreation. At one o'clock walked, met Judge Patteson, a coze with him. Called on Spiller, librarian of the House of Commons. Davies Gilbert in the library, very curious to hear about the Eifel volcanos and the gravel of Rotherberg. Stepped into a neighbouring *café* and took a cup of coffee; on the table was the 'Westminster Review'—read a splendid extract from Napier's 'Peninsular War.' It must be a noble work. One day last spring, when I called on Sedgwick, he read me a whole chapter of his friend's book, an animated and graphic sketch of a skirmish in Portugal. Scott in his best historical novels never made you more completely present on the spot. Returned, and worked two hours; have made great way to-day, and yet a day of much enjoyment withal; seven hours' work, and quite fresh. I shall take a walk to the Athenæum. Is it not strange, after what I have said above, that at the Athenæum the first man I sat down beside was Colonel Napier?[5] I was struck with his conversation, addressed to Stokes, and on asking who he was, found it was he whose third volume I had been admiring; a fine-looking man to boot. Stokes showed him a five-franc piece of Henry V., for the Bourbons are carrying on a parody on the exiled Stewarts to the last. There are coins which Stokes has of Henry Ninth, King of England. Did you ever see Stokes's toy of the man whose head you can cut through with a penknife? Napier remarked, 'In these times such a gift would serve a king better than such dollars.' In the library found Greenough and Decimus Burton. Greenough turned up to a note he had made on the Rotherberg in 1816. It struck him in every respect as it did me—no trap in the gravel, which therefore is not posterior. He speaks of a section by the walnut-tree near the farm-house in the crater, which I missed.

[5] Sir William Napier, K.C.B.

To Dr. Fleming.

London : August 29, 1831.

My dear Dr. Fleming,—I was very glad to hear from you, on my return from a tour of four or five weeks to the Eifel, that tract between the Rhine and Moselle, in which abundance of extinct volcanos have burst through a country which is composed of strata much like the Sidlaw (where it is free from trap), the same sandstone and shale, and similar fucoidal plants, connected in some few parts with trilobite limestone, and with genuine *old* coal. Through these the supra-marine volcanos burst, and strange holes have thus blown through the mountains, each eruption having been almost invariably at some new point. I daresay you may have heard of a certain case of diluvium of the Rotherberg, *i.e.* gravel on one side of the crater of one of these modern (tertiary) volcanos. The fact is, it proves nothing as to the post-diluvial, or rather post-alluvial origin of that volcano. The gravel was there before the eruption, and contains no volcanic matter. I never saw so clear a case, and it is one of ten thousand proofs of the incubus that the Mosaic deluge has been, and is I fear long destined to be on our science. Now I am fully determined to open my strongest fire against the new diluvial theory of swamping our continents by waves raised by paroxysmal earthquakes. I can prove by reference to cones (hundreds of uninjured cones), of loose volcanic scoriæ and ashes, of various and some of great antiquity (as proved by associated organic remains), that no such general waves have swept over Europe during the tertiary era—cones at almost every height from near the sea, to thousands of feet above it. I mean when lamenting the rash introduction of such hypothetical agency, to hint at the unfairness of gaining votes for new 'guesses' by the temptation of a promise to explain the Mosaic deluge, if they will consent to adopt these new views.

At the same time, I intend to allude to the debt due to *you*, for having been the first who had the courage to maintain the untenable notion of a non-exploded dogma, and of having faced the obloquy which others are at this day no longer in danger of sharing.

I don't lecture till April, and unless I see the Institution promising very well, shall only give a very short course of nine lectures at the most, on a branch of the subject. Some of my friends think it was a foolish fancy. Others, with Whewell, that it will serve 'to give an anchorage to my thoughts, and keep me more steadily to our great subject.'

Remember me kindly to Mrs. Fleming, and believe me, ever most truly yours,

CHARLES LYELL.

To G. MANTELL, ESQ.

London, August 30, 1831.

My dear Mantell,—I hope you got my letter after my return from Germany? Since that I have been detained here much longer than I expected, and am now on my way to Scotland; first to Edinburgh, then to Forfarshire. I wish much to hear from you, as your silence has made me uneasy. Write to me here, and your letters will be forwarded free to me wherever I may happen to be at the time in the country. Barrow has sent me a box of specimens from the new island[6] thrown up off Sicily in a spot where I did not at all look for a submarine eruption, but am nevertheless well satisfied therewith. Chocolate-coloured sands and scoriæ of the same hue. The 'Britannia' man-of-war passed over the spot some months ago, and feeling her bottom struck as if by a rock (slight earthquake), she sounded, and found eighty fathoms. Now the isle is 200 feet above water, and is still growing. Here is a hill 680 feet with hope of more, and the probability of much having been done before the 'Britannia' sounded. I congratulate you, one of the first of my twelve apostles, at Nature having in so come-at-able a part of the Mediterranean thus testified her approbation of the advocates of modern causes. Was the cross which Constantine saw in the heavens a more clear indication of the approaching conversion of a wavering world? more especially as the first box of specimens from the new isle came through the post office by the Mediterranean steam packet, and was

[6] Graham Island, which rose August 1831 in the Mediterranean, and towards the close of October was nearly levelled with the surface of the sea.

presented by Barrow to me before he had opened them himself, eight or nine days after they had been thrown up hissing hot.

Ever most truly yours,
CHARLES LYELL.

To MISS HORNER.

Steamboat 'Soho,' Orford Ness : September 1, 1831.

I have been profitably employed this morning since breakfast in reading Conybeare's last little work, and several chapters of Omalius d'Halloy's new 'Elements of Geology.' What a proof of the interest now excited by the science, that since my first volume appeared we have three works, Macculloch, two volumes, De la Bêche, and this, on Geology, besides innumerable memoirs !

September 3.—'Soho,' off Bass Rock, three o'clock. We are at last in calmish water again in the Forth after a rough, rainy, and very slow passage, against a north wind. All ill, and I was obliged to lie in my bed nearly all day yesterday. I had an agreeable compliment paid me in conversation, which I overheard. One of the party was describing the washing away of the small port of Carse on the Solway Firth, near Dumfries ; which led another to say, 'Have you read Lyell's account of the ravages of the sea of the E. and S.E. coast of England?' To which a blind old talkative gentleman, who I learnt was a Dr. Milligan, replied, 'I have ; it's by far the first work on that science, and the writer, ye ken, is a countryman of ours.' On the score of his being aware of the latter circumstance, I deduct one half from the value of the eulogium, and am satisfied with the remainder.

Edinburgh : *September* 4.—I have just ten minutes to spare, before dining in Charlotte Square, and I doubt not you will like to hear all that passes between me and your old friends. Macbean took me to call on Mr. Thomson,[7] with whom I was much pleased. He told me he had heard Chalmers[8] preach, and make a somewhat wire-drawn dis-

[7] Thomas Thomson, advocate. 'Formidable in dignity and in antiquarian learning.'—*Lord Cockburn's Memorials.*

[8] The celebrated Scotch divine.

tinction between an ungodly man and a sinner. 'Wonder what he would make of an ungodly sinner?' said I. Finding the celebrated preacher was to perform service in the afternoon, I determined to go. I went to the kirk, and for a shilling got an excellent place, which is a great point, as there are many words in Chalmers' sentences which one may miss if not very near. I have a great prejudice against popular preachers in general, and almost all I have heard have strengthened my original impressions. But not so in this instance. It was a very long discourse, but admirable. The subject was 'repentance,' a hackneyed one enough. You are to repent to-day, not because it may be too late to-morrow, as you may die; but because, though you are to have ever so long a life, your case will be more hopeless should you resist this warning. Your mind will be hardened by the habit of resisting. He then explained the effect of habit, and its increasing power over the mind, as a law of our nature, with as much clearness and as philosophically as he could have done had he been explaining the doctrine to a class of university students in a lecture on the philosophy of the human mind. But then the practical application was enforced by a strain of real eloquence, of a very energetic, natural, and striking description. I hardly think any critic could have detected any expression or image that sinned against good taste, although he was very bold and figurative. But unfortunately, every here and there he seemed to feel that he was sinning against some of the Calvinistic doctrines of his school, and all at once there was some dexterous pleading about 'original sin,' which interfered a little with the free current of the discourse, and gave me an idea, that in order to be popular with a Scotch congregation, a preacher must deal a good deal too much in the unintelligible doctrinal points of theology. Upon the whole, however, judging from this single specimen, I think I would sooner hear him again than any preacher I ever heard, Reginald Heber not excepted.

September 5.—When I got to Mr. Maitland's this morning, I found him with an excellent newspaper account of the new volcano in the Mediterranean, prepared for me to read.

The Solicitor[9] did not arrive till half-past eight o'clock. You would have been amused with the first interview. Maitland, having been employed to draw up for the new Reform Bill the boundaries of the borough of Musselboro', was showing his map to me; so when he introduced me, Cockburn gave me a moderately good reception, a bow, and, if I remember right, a shake of the hand. We all began to move to the breakfast room, when the Solicitor exclaimed (the first sentence I heard from him), 'Is it *Mr. Lyell?* Lord! I thought it was some d——d surveyor come about your map.' Then he shook my hand in right good earnest. On my telling Cockburn how much I was struck with Chalmers, he gave me a most favourable sketch of his various acquirements, private character, &c., and said that Chalmers was now studying so hard, that he had told him (the Solicitor) that he had been *idle* all his life before. On my observing that I could not agree with Macbean, in wondering at the small number of successful popular preachers, because they had such trammels to contend with in the pulpit, so many religious dogmas to steer clear of, &c., Cockburn said, 'Besides, how many of the most popular weapons of oratory are utterly prohibited—sarcasm, irony, ridicule!' I agreed to go to Bonaly[1] to-morrow. I then sat down, and took a good hour and a half's work at composition of the MS. chapter of my second volume, which I left off at in town. I delight in thus making the business of acquaintance-making and calling on people the mere recreation necessary between hours of work. After this set-to, I found, thanks to the lawyers' early hours here, that it was only twelve o'clock. Called on T. Allen, not in town, then at Jamieson's. I then went to Hibbert's, at home, glad of it, as I wanted a good confab about the Eifel, to which he had laid a six months' siege, whereas I had only attempted to take it by storm in as many days.

Kinnordy: *September* 8.—On my arrival here, I found every one quite well, and two letters from you. Mrs. Hibbert's

[9] Solicitor-General for Scotland, afterwards Lord Cockburn, author of *Life of Jeffrey*, *Memorials of his Time*, an old and valued friend of Miss Horner's family.

[1] Lord Cockburn's country-seat near the Pentland Hills, Edinburgh.

drawings of the Eifel are really splendid, most of them worth publishing, yet when she began the tour, she had hardly attempted to sketch from nature. She has caught that style of Scrope which gives you a sort of map-picture of a country, a half panorama taken from high points. A view, for example, from a hill looking down upon the Laacher See, and taking in the whole lake, and the hills surrounding it, and part of the adjoining country. Never having heard of that beautiful map which Von Oeynhausen lent me, they lost much time in constructing a map, which Hibbert did trigonometrically. They have really collected both rocks and shells, and worked and sketched to great effect. In the 'loess' descending from Kruft to Andernach, they found a vast number of land shells, which seem to indicate a modern date to that formation. About nine o'clock Dr. Greville[2] came in, and insisted on my breakfasting next morning, promising as a bribe that he would get ready, if I came, a drawing of the new volcano in the Mediterranean, copied from one an officer has sent him, as a present for the 'Sky Parlour'[3] here. At ten o'clock I went to Mr. Thomson's—a capital supper—grouse, &c., and all good things, and the guests just sitting down as I entered—Mr. Maitland, Professor Napier,[4] Professor Pillans,[5] and one or two more. Pillans has been with a friend along our Angus coast, geologising in an amateur way for his health. Next morning early I went to call on Maclaren, that furious radical as Editor of 'Scotsman,' and a mild, amiable, simple-minded man in private, and a great reader and lover of geology. Greville's drawing of the volcano was quite beautiful—his talent of rapid drawing and colouring is truly enviable. Hibbert was there, and quite delighted with a piece of antiquarian geology which T. Thomson had given me at supper. He has fished out an old Latin legend, I believe in Pinkerton's 'Lives of the Saints,' of St. Niniano (or St. Ringen in corrupt English), evidently founded on those impressions of the feet of animals which have recently made such a noise in the geological world, preserved in the Dum-

[2] Botanist, author of *Cryptogamic Flora*, &c.
[3] Museum at Kinnordy.
[4] Macvey Napier, editor of *Edinburgh Review*.
[5] Professor of Humanity Chair in Edinburgh.

friesshire red sandstone. The saint had collected all the cattle of that country, to sprinkle them with holy water and bless them. A thief thought it a good opportunity to steal a few, but a bull ran at him and kicked him dead, and the saint softened the rocks, so that like wax they received every impression of the furious animal's hoofs as he plunged about, and then they were hardened in attestation of the miracle. Hibbert offered to show me a gun of the Spanish Armada, encrusted with shells, fished up from the sea, and other antiquarian remains, bearing on a chapter I was then writing, canoes, &c., so we went to see them. Macbean showed me Williams' original paintings of scenes in Greece. What a glorious country their poets had to write about, as far as natural scenery was concerned! He was a fine artist. When we arrived at Bonaly, the Solicitor-General was waiting, ready for a walk; showed me the bowling-green, then to the terrace, which I admired much, though the distant view was lost in the haze. The white pony came to receive his caresses. At the end of the walk I was shown the statues of Robert Bruce and another, 'which the mason had painted white, and Horner cleaned by whole bottles of acid.' After ascending to the top of Graham's Dell, he showed me the marsh surrounded by rocks where the Covenanters used to preach, then over the height, and down to the *Linn* by the single elm tree. 'Here I have seen Frances[6] stand with an umbrella, which keeps off the water longer than you would think, picking wild flowers.' Then we went over Mushroom Hill, where we filled our pockets with mushrooms, and back by Torphin. He talked to me much of Brougham, how treacherous as a friend, and how gigantic his power as a servant of the public. He has cleared off nearly all arrears, and if he does what he proposes here (all the forty appeals, Scotch), he will do what has not been done for centuries. I talked to him of the state of France, when I was there last year, their new peerage bill; of Spain, of which he asked me much; of Buckland, with whom at Craig Crook he was much delighted; of Etna, and I made him understand the difference between the volcanic and other rocks of the Pentlands in the dell. This led him to talk of Playfair, and he cited an

[6] Miss Horner's next sister, now Lady Bunbury.

elegant passage of his about Hutton. On these and fifty other subjects did we enlarge, and I think exchanged more ideas than I have often done with men with whom I have been acquainted for years. There is a delightful simplicity of character, an entire absence of ceremony, without any unpleasant familiarity, and without inviting it, a disposition to be amused and informed, and a wish to be thoroughly idle, when he is not working, that is delightful in him; and I observed that he could in an instant, on his return, sit down to severe work, for he has a dreadfully difficult case about patents submitted to his arbitration, which takes up much time. This decision, whatever it be, must ruin one or two very rich men, for the law is in a state of disgusting confusion and ambiguity. Mrs. Cockburn had returned from Edinburgh, where she had been spending her morning with her sister. I thought her very kind, and what is no small merit, always looking so happy and cheerful. On my return to the drawing-room, I found a carriage arrived with Napier and T. Thomson. We sallied out again for a walk in the garden; Cockburn with Thomson, and I with Napier. From the latter I learnt many particulars respecting Playfair's style of composing and amending his MS., which amused me, and some good anecdotes of Dugald Stewart, of whose style of writing I have always been a great admirer. At dinner, the principal fun was a general attack on Napier, for having been shooting three whole days, and not having yet taken out a license. At first Thomson told him with such gravity how concerned he was that an information had been laid against him, that he was literally alarmed, and began to guess who had done it, or instigated the informer. When he began to hope it was a joke, Cockburn said, 'How can you expound the law to a class after thus violating it? Why the very act is an implied forfeiture of your chair!' Cockburn told us of a curious action which was brought against the Siamese twins, who had been out shooting, and had returned blows on being assaulted by a Colonel. This led me to talk of what I saw of these youths, and when I mentioned how freely they conversed with others, and yet never to one another, he asked me why? 'I suppose they are each acquainted with so precisely the same facts, that they have no

ideas to exchange. Do you not remark that people of the same family, who always live together, sometimes sit silent, although the best of friends, and yet are talkative to strangers?' 'Yes,' he replied, 'and I have often thought that scarcely any companionship, scarcely any conviviality is so delightful, as that same *social silence*.' He laid a deep emphasis on these last words, which brought forcibly to my recollection many an occasion when I had felt the same, and when I would have preferred to walk or sit in a room with one I loved without speaking, to any conversation with an indifferent person. Cockburn asked me about the Zoological Gardens in town, and on my describing the prehensile tails of the 'spider monkeys,' declared he had often thought that if men had had tails, what volumes would have been written on the peculiar beauty of such an appendage to the human form, and of its utility, &c. Then he went on with speculations on the sort of caudal ornament he should like for himself. He put Napier on the defence of the last No. of the 'Edinburgh Review,' protesting against it, as the dullest, heaviest, and most unreadable one ever published; but all in joke, and the editor took it well, and really fought a famous battle—much better than about the license. It appears that Sir William Hamilton wrote that stirring article about Oxford. In short we had a most agreeable merry party, and when I went away Cockburn made me promise to call on him the moment I returned to Edinburgh.

I left Edinburgh for Kinnordy, and met Marianne and Caroline at Glamis, and in an hour afterwards was at Kinnordy, having spent only three days most agreeably, and you will allow not idly at Edinburgh. The drive from Kinross to Perth through Glen Farg is beautiful, and not having been able to get an inside place, I enjoyed a seat on the outside on a sunny day very much. I found the place here in great beauty, the more so after the uncommonly sunny summer which they have enjoyed, and which has still left all things green, but with a warm look upon them. I like the change in the garden very much, the turning part of the flower borders into the English style, and a magnificent rank and file of dahlias now in full blow.

September 9.—I must return once again to Bonaly. I

forgot to say, that when we rejoined the ladies after dinner, there was an animated conversation about Dugald Stewart's monument, which is now rising on the Calton Hill, and I think promises to be beautiful. Turner, R.A., when in Edinburgh this year, augured ill of its effect, but I foretell it will be no failure. Cockburn wishes to have Dugald Stewart's bones removed to the spot. Some one (Napier I think) declared that the relatives would not have them taken from consecrated to unconsecrated ground, but Thomson denied that they had any objection. 'It is not for the sake of the bones being really there,' said Cockburn, 'but if people could be made to fancy it, their associations would be stronger of the monument belonging to the man. Well, I will grant you, if you please, that this is mere illusion, and what is more, one which I do not require to aid my feelings, but others will; and a procession would not be enough, unless the bones were carried there, or some of the bones.'

Kinnordy, September 12, 1831.—After Hall's arrival (the day after I came here), I set to work as of old in the 'India paper room,' a most cheerful drawing-room and a fine height. The paper, covered with birds, &c., was made by order for the room, and is not faded in thirty-five years. Walked with Marianne with baskets for mushrooms, which we filled, so that they were heavy to carry to the hill above Kirriemuir. A glorious view and day.

Letters from Donald Ogilvie (Lord Airlie's brother) canvassing us for the county, Maule, M.P., having become Baron Panmure. Others from Hon. D. Halliburton (brother of Lord Aboyne) who opposes on Maule's interests. I had risen early to secure two hours before breakfast, after which went to the Episcopal chapel with a large party. I then rode to Cortachie Castle, and apologised to Lord Airlie at never having acknowledged the letter of his agent announcing my nomination as Deputy-Lieutenant of the county.

I am getting on very steadily with my work, and really believe as well as in town; which I like to believe, as nothing can be more cheerful than the whole party here at present, my mother being in very tolerable health, and all the rest as well and happy as the day is long.

September 15, 1831.—Cockburn mentioned to me in

my walk with him at Bonaly, that the best thing Playfair ever wrote in point of style, was a controversial pamphlet on Dr. Reid's eligibility to a Professorship at Edinburgh, notwithstanding certain alleged unorthodox opinions which the ministers of the Kirk charged him with entertaining. As it is precisely the kind of topic which I have been obliged to touch upon in my history of the progress of geology, and may have again, I should much wish to read it, but cannot buy it, as it is out of print. I will try and think of any work on Switzerland or the Alps for you to read. I wish you could get up the geography of the country of the Alps and neighbourhood, which E. de Beaumont has made the foundation of his 'successive elevation theory.' I must take things in their turn, and shall be unable to think of our tour much for some time. As to geology having *half* of my heart, I hope I shall be able to give my *whole* soul to it, with that enthusiasm by which alone any advance can be made in any science, or indeed in any profession.

September 17.—On Thursday the 14th, by way of a lark (to use a slang term), we went, seven of us, with a wheelbarrow to the hill of Kerry, and filled it entirely full of mushrooms, besides five baskets full. Much joking about setting up a ketchup manufactory, and chalking the walls of Kerry with 'Lyell's Matchless Ketchup.' To-day walked with Marianne to seek for ferns and other plants, which Stokes wants for his herbarium. Dined at Baldovie: went in the open carriage, and returned at night by a fine moonlight. Laing Mason and several other lairds at dinner.

CHAPTER XIV.

SEPTEMBER–DECEMBER 1831.

NEW VOLCANIC ISLAND IN THE MEDITERRANEAN—LIFE AT KINNORDY WITH HIS FAMILY—ELECTION EXCITEMENT—MURRAY OF SIMPRIM—RETURNS TO LONDON—DINNER AT THE LINNÆAN CLUB—CUMMING THE SAIL-MAKER—GEOLOGICAL SOCIETY MEETING—DUKE OF SUSSEX AT THE ROYAL SOCIETY—VISIT TO JERMYNS—THINKS OF GIVING UP HIS PROFESSORSHIP AT KING'S COLLEGE.

JOURNAL.

Continuation of Journal to Miss Horner.

Kinnordy : September 20, 1831.—A frank brought me a Malta gazette, containing an excellent account of Graham's Island, the new volcano in the Mediterranean. The island is 160 feet high, a mile in circumference, and twenty-five miles from Sciacca in Sicily. It has been landed upon, but is expected to be washed away in time by the sea, which has already made perpendicular cliffs since the eruption. One fragment of limestone has been found on it unburnt, thrown up from below. The submarine eruption is still going on with great violence.

After my usual morning's work on Monday, I went to see Fanny's [1] bee-hive. Yesterday she tried the stratagem of taking away the honey, and then uniting the bees with those of another hive, instead of killing them. Strange to say, it is believed that in consequence of the additional heat generated by a double number of bees, they eat so much less ; that the consumption of the two hives when united is, during winter, no more than that of one when separate. One hive is put under the other in the night, and the bees go up to the higher one, which is full of honey. When the swarm there

[1] His sister.

is sleeping, and during the night, they acquire the same smell, and in the morning are recognised as part of the same fraternity. Nearly all entered; but five or six dozen did not get in, but tried to enter next day, when I saw them. They were detected as strangers, and much fighting ensued, and lots of dead bodies were cast out of the entrance, until nearly all who had been excluded, and probably some of the others, were killed, as also one queen bee, for they never suffer two in any hive.

One of the great amusements here this summer seems to have been to watch the bees defending the entrance of their hive against a tinea, a species of moth of the same genus, and nearly the same size as the clothes moth, which happened to swarm by thousands every night. The guard at the door was trebled while the pest lasted, and numbers were employed in dragging out the moths which entered to plunder the honey. Tender as these tinea appear, they rarely are killed. The wasps are great depredators, and swarm also; they are usually pulled out by five bees, but are scarcely ever killed. Caroline says, 'A wasp looks so like a thief hustled out by a party of constables!' I afterwards rode with Eleanor a most beautiful ride, across the Prosen, and a ford of the Esk, to Cortachie Castle, and then to Downie Park.

Sir James and Lady Ramsay came early to dinner. Ramsay wanted me to go to Banff, but as I had declined Captain Farquharson's tempting invitation to go with him to Invercauld, I could fight off with a good grace. They always make me a speech here about 'knowing how fully my time is employed,' &c., which would annoy some people who like to be thought to produce books without any effort; but as I have no such vanity, I am content to be thought privileged to do as I like. I took Ramsay to the top of the Tower,[2] and to see the Canoe:[3] afterwards walked with Caroline and Eleanor[4] to a 'den' on the river Carity, to collect ferns for

[2] In the garden at Kinnordy, containing a museum of curiosities.

[3] An ancient canoe taken out of the marl in the Loch of Kinnordy, in the summer of 1820. See *Transactions of the Geological Society*, 2nd series, vol. ii. plate x.

[4] His sisters.

Stokes, and got five species on the rocks. My door is open, and I hear Lizzy,[5] who is the best performer, playing 'the Bonnie House of Airlie,' of which she has a beautiful set. The two parrots which Tom brought from Africa are chatting away in the passage, but neither of them are given to screaming now, as they were apt to do at first. To-day the Mudies of Pitmuir, cousins of ours, but not very near, came to make a call from six miles the other side of Forfar.

September 24.—I went a long ride with Eleanor to Balentore, went over the shooting quarter, which is a suite of 'laird's rooms' attached to those of the farmer. We went hunting a little for ferns and lycopodiaceæ, and with tolerable success, and returned by a different road. Balentore is our northernmost farm, fairly in the Grampians, and among the grouse.

If you are not frightened by De la Bêche, I think you are in a fair way to be a geologist; though it is in the field only that a person can really get to like the stiff part of it. Not that there really is anything in it that is not very easy, when put into plainer language than scientific writers choose often unnecessarily to employ.

My father, Maria,[6] and Fanny went to make a long round of calls in the open carriage, to Tealing—Mr. and Mrs. Fotheringham Scrymgeour; Sir John Ogilvy's, Baldoven House, near Dundee; Miss Graham of Balmure, &c. Sir John's family was in times of old, as tradition says, a branch of the Airlie stock before they were titled, and they (Sir J.'s ancestors) possessed the feudal castle of Inverquharity, which now belongs to my father, about four miles from here. It is in the valley of the S. Esk, and by far the best wooded and most beautiful part of our property. Although much fine timber has been felled there in the last twenty years, it would stand not a little cutting now. The river and park scenery about that place is so very superior to anything near Kirriemuir, that many think Kinnordy should have been built there. I rode with Eleanor and Maria to Pearsie, a beautiful highland place, and most comfortable house. When a boy, just before I went to Oxford, I thought it a perfect Paradise. When I visited it at that time it was a Mr. Wedderburn's, and Mrs.

[5] [6] His sisters.

Somerville, when Miss Fairfax, used to stay there, and as a girl came over from it to dine at Kinnordy, in my grandfather's time.

September 27.—To-day I went with Eleanor a long walk up the hills behind us on the north, and got two more plants for Stokes on the Clune and Castle Hills, where we started a great number of blackcock. On my return I found Dr. Fleming just arrived. He showed a strong interest about King's College, and I told him that as I had received my nomination in a manner that was highly complimentary, I should do my best for a short course. Upon this he said, 'If you lecture once a year for a short course, I am sure you will derive advantage from it. A short practice of lecturing is a rehearsal of what you may afterwards publish, and teaches you by the contact with pupils how to instruct, and in what you are obscure. A little of this will improve your power perhaps as an author. Then, as you are pursuing a path of original and purely independent discovery and observation, it increases much your public usefulness in a science so unavoidably controversial to have thrown over you the *moral protection* of being in a public and responsible situation, connected with a body like King's College. But then you must stipulate that you are to be free to travel, and must only be bound to give one short course annually.'

I perceive you are very busy and studious, which gives me great pleasure. Though I was born with a taste for natural history, I find that if I take up a new branch—botany for example, or conchology—I am obliged to do very little at a time, or I get a temporary distaste. It will never do to force these things, either on ourselves or others. Dr. Fleming has been spending much time in the Sky Parlour, selecting duplicate insects, some of them handsome things, which Eleanor brought from Jermyns[7] last spring, and which are not Scotch. He has no collector's box with him, which he says proves he came with honest intentions; but he was greatly delighted to hear that ——, when here, had the inside of the crown of his hat *lined with cork!*

Kinnordy: September 30, 1831.—The papers of this

[7] His uncle Captain Heathcote's place, near Romsey, Hants.

morning were full of the dreadful hurricane of Barbadoes, in which 3,000 persons at least are said to have perished, and the whole island to be now a desert. This morning Dr. Fleming went away in spite of us, in our open carriage to Forfar, at a quarter before six o'clock, to meet the coach in a hard rain, which has continued all yesterday till to-day. I think I omitted yesterday to mention a letter from Tom to Eleanor from Portsmouth. 'We are under weigh for Cork, where we are to rejoin Admiral Codrington's fleet.' Sophia and Lizzy have discovered that an election is a good thing, as there is to be a ball on the 10th (a county ball) at Forfar, which has grown out of it. As we could not go out for the rain, we had a good game of battledore and shuttlecock, with some famous rackets which I brought from Paris last year.

October 3.—My father went to the election to-day at Forfar, and I have done a great day's work, nearly finishing my fourth chapter. I walked with Eleanor, and got a few ferns, and in the garden for apples. *Eight o'clock.*—Messenger arrived with the news that the Tories have triumphed, and Colonel Ogilvy is M.P. Sophia tells me it is quite right that Colonel Ogilvy should be member, because he will conduct the Forfar ball with more spirit.

October 4.—Yesterday I took a walk with Maria to Kirriemuir quarry, the largest in this country, one of my father's, which, although not a very valuable possession, is really a fine object. Lord Airlie called to-day in his carriage and four, and Captain William in his carriage, when I was out, a sort of formal way of paying a visit of thanks. But his manner was anything but formal, and he thanked my father as warmly as if he had put his brother in. When Eleanor and I called at a cottier's to-day, an old woman said, 'It has been sair work to get on, they Parliamenters,' alluding to the 14,000*l.* spent last year by the Airlies in trying to get into the borough. But this county election has not I suppose cost 300*l.* My brother Harry was to have been on the roll this year, but I am glad my father has stopped it, as certainly it would be throwing away money, for a reform in the Scotch system cannot be far off. I went to call on my old nurse Nanny (or Mrs. Yeates) to-day, who

is not well. She talks away with the familiarity of one of the family, in which she takes a real interest.

October 8.—Mr. Blackadder the surveyor came from Glamis to consult about a map of the county, which he is to construct for a joint memoir on the Geology of Forfarshire, for which we have been preparing materials for years, to be published by the Geological Society.

Sunday.—Walked with Eleanor to chapel, where the carriage also went full. The principal talk was about a dire event, no less than the putting off of the county ball. which was to have been Sophy's and Lizzy's first Forfar *début.* And why? Because Mrs. General Hunter, the directress, had heard that the Forfarians were resolved to break every carriage to pieces of the Tories, if on Monday the news should arrive, as they anticipated, of the bill being thrown out by the Lords! Dresses and all for nothing! and the Miss Drummonds staying at Cortachie for nothing else, and a large party at Logie for the same. So Colonel Ogilvy, the director, was obliged to send round notice only two days before, that the ball was put off.

October 9.[8]—I hope the returns of this day, as long as my life lasts, will very rarely see us separate; never, I would willingly say, if I thought all my wishes could be realised.

I rode alone to Glamis, to choose some plants (fossil) which Blackadder's wife and daughter had collected, they having taken a fancy to fossilise. He rode back with me as far as Kirriemuir. Met Wedderburn Ogilvy of Ruthven, who rallied me on my republican principles—but in great good humour he said, 'As you are looking better than last year, I presume you have not been fagging so hard.' When I returned I found that my father, Fanny, and Sophy were gone to dine at Fotheringham, and to sleep.

Thursday.—The Fotheringham party returned. They met Sir Francis Walker, Lady Drummond of Hawthornden and daughters, Mr. Fotheringham Scrymgeour, Lord Airlie, &c. It was just an Angus set-to of the old *régime.* They arrived at half-past six o'clock, and waited dinner one hour. Gentlemen rejoined the ladies at half past twelve o'clock! They in the mean time had had tea, and a regular supper laid out

[8] Miss Horner's birthday.

in the drawing-room. After an hour with the ladies, they returned to the dining-room to supper at half-past one o'clock, and my father left them all at it at half-past two o'clock!

The ladies did not go to *this* supper. Cockburn remarked that Forfarshire was the last stronghold of those Scottish habits being maintained, but it is fast wearing out. I forgot to say the other day at Cortachie that the conversation turned on a trial now pending at Perth on Lord Mar, for shooting at a man with intent to kill and wounding the horse. Lord Airlie said, 'I was very lucky once. An old man and a youngster came to fish at Airlie Castle, and I warned them off in the morning, so they went; but when I came back in the evening I found them again, and broke the old man's rod, and on the other's making off, shot at him when 90 yards off, and peppered him, so that he was obliged to have the shots extracted. Fortunately for me he did not prosecute.' Erskine of Linlathen did not vote for Colonel Ogilvy, because he will not take any oaths. He (Erskine) has built a house 220 feet long in front, they say the largest in Angus.

Our parrots have acquired a nice accomplishment, that of imitating the squeak of two doors as they move on their hinges, and of a wheelbarrow of which the wheel squeaks. Whenever they see the passage door move, they set up this concert, which I am now enjoying, and when they see the gardener's man, we hear the barrow performed. This has replaced the dog whistle, with which they used to salute Tom. All the sisterhood (five of them) went this morning to Dundee, with a beautiful basket of ladies' work, which I hope will bring 8*l.* or more for Lady Ramsay's table. They had the large carriage, with a pair of horses besides our own, a nineteen miles' stage.

October 15, 1831.—Our five lassies returned from Dundee. They sold their ladies' work at high prices, and it seems to have been an amusing meeting. Many gentlemen, to show their gallantry, were buying at the tables of ladies of their acquaintance. As they came back through our village of Kerry at night, a mob of about 40 reformers *hissed*. They put down the windows lest stones should be thrown, but this

it seems was not intended. They think that as they had four horses, it was taken for Lord Airlie's carriage, but perhaps it was in honour of my father's Toryism.

October 24.—The Murrays of Simprim arrived. Having a horror of the habits of a considerable set of the Angus lairds, Murray voted himself a Perthshire man, and would have nothing to say to them. Indeed, had he been in my father's place, I am persuaded that, like him, he would have emigrated. But Mrs. M.'s great friend, Mrs. Farquharson of Invercauld, persuaded her to visit her namesake of Baldovie, and there I met them some seven years ago. I soon found in Murray, and he in me, a congenial spirit, and he was always asking me to Meigle, about ten miles from here, in the direction of Perth, where his place is. I went occasionally, and found him an original character, with a great love and respect for science, and who had all his life cultivated literary society; full of anecdote, and who had the art both in the country and when in town of filling his house with an agreeable society. He used to go occasionally to the Royal and Geological Societies with me, and at last they called at Kinnordy, in spite of the rule they had laid down, and continue to visit here. Our party was Mr. and Mrs. M. and their youngest daughter, about twenty years or twenty-one; Mrs. Kinloch and her sister Lady Ogilvy (the dowager); Annie Kinloch; John K. (the laird of Logie); and Mr. James Ogilvy. Murray told me that his cousin, Sir Alexander Mackenzie, had refused to read my book when he, M., bored him so to do; but lately he fell in with it somewhere by accident, and has been most active recommending it to all his friends.

Kinnordy: October 25, 1831.—I see by the paper that Leslie, Brewster, Ivory, Herschel, and Charles Bell are knighted —Guelphic Order, I believe. I begin to think that all our acquaintances will soon be dubbed Knight-Bachelor.

Edinburgh: 27.—I had an inside place in the coach, and read with much pleasure and profit, Playfair's Dissertation on the Progress of Physical Science in supplement to the 'Encyclopædia Britannica,' which Mr. Maitland procured for me when I was last here. I think I can give a new definition of geology modelled on Playfair's definition of Physical

Astronomy, which I will give you to read to your father, as he thought my former definition open to criticism, and I shall be glad to know if he likes this. 'Geology is a science arising out of the comparison of the phenomena of *past* change, observed on the surface and interior of the earth's crust, with the laws of chan ge*now* regulating the terrestrial creation, whether animate or inanimate.' It is perhaps too abstract for general readers, yet may be useful in the body of the book. A definition, I suppose you know, is of all things the most difficult, and must in the present state of geology involve a theory.

Saturday.—I shall write a few words before I get into the steamboat, just to tranquillise my mind a little, after reading several controversial articles by Elie de Beaumont and others against my system. If I find myself growing too warm or annoyed at such hostile demonstrations, I shall always retreat to you. You will be my harbour of peace to retire to, and where I may forget the storm. I know that by persevering steadily I shall some years hence stand very differently from where I now am in science; and my only danger is the being impatient, and tempted to waste my time in petty controversies and quarrels about the priority of discovery of this or that fact or theory. I am glad to see that E. de Beaumont has reiterated in more explicit terms all those general views which I expect to overthrow, intoxicated, perhaps, by Sedgwick's eulogy, who was carried away by the novelty and dashing assertions of E. de Beaumont.

Monday.—I have been writing a few sentences for my work, and reading 'Don Quixote,' which is provided by the librarian here. We shall have a third night of it in the river, which we must not complain of, as we have had still water the whole way. I am convinced that if I can but keep my mind moderately fixed to the publication of my volume, that I shall outdo expectation in this volume; but as the part I am now about is of necessity, from the present state of the science, exceedingly controversial, and as I am contending at once seven or eight distinct points with no less persons than Sedgwick, Conybeare, E. de Beaumont, and three or four others, you may well suppose how very carefully I must weigh every word and opinion. I see by the new articles

just out that they are beginning to differ from one another, as well as from me, and I shall make new schisms among them by this volume. I shall be as careful as possible not to controvert uncivilly.

London : November 2, 1831.—I have most to tell you when in town, but least time to spare for writing. I fled from the confusion of unpacking, to the dinner of the Linnæan Club, which is always amusing. In a few minutes I forgot I was just off the sea, and heard all the news. Old Lambert, Prince Cimitelli, old Caley, and myself were all that sat down; an unusually thin meeting, but a merry one. Adjourned to the Society's rooms, and heard a learned botanical paper by Robert Brown, on the fructification of the Orchidaceæ. I was glad to meet my friend Dr. Hooker the botanist, also Burchell the African traveller, whom I had not seen since his return from the Brazils. Bicheno, Wallich, Curtis, all had some news to tell me; a week's reading of reviews and magazines in Angus, or at the Manse of Flisk,[9] would have given me less information about what is now going on, and *coming out*, in sciences connected with my department. And then, the excitement is so useful; many inquiries what precise *page* I had arrived at in print. I was glad to see Curtis the entomologist, and to compliment the meritorious but ill-requited author of the most beautiful and scientific work on insects ever published in England, on the merits of his last number, which I had found on my table. The great news of the day among the *collectors*, was the arrival of the long expected *sail-maker*, Cuming, a man who, having made a little money in trade in Chili, some ten years ago, and fished up a few new shells, which brought in in London six or eight guineas each, took it into his head to build a small sloop, and sail along the American coast and isles of the Pacific, dredging for shells and corals, and observing their habits, as also crustacea and other classes, till he filled four hundred chests of things, numbers of them quite new.

On my return home, I found my chum Broderip glad to see me. After a morning's work, went with Broderip to the sail-maker's, and found not a few eagles gathered together around the carcass—Lambert, Gray, Children, &c. His

[9] Dr. Fleming's Manse in Fife.

treasures only half unpacked, but much that was interesting. Dinner at Club of Geological Society, as usual an agreeable meeting. Murchison in the chair, agreed to meet on Friday, and tell me lots of news. Greenough, Broderip, Pringle, Stokes, Basil Hall, and strangers. Basil Hall brought his newly purchased autograph of the 'Antiquary,' by Sir Walter Scott, and two pages of preface lately written by Scott at Portsmouth, in his own handwriting, giving his reasons to Basil Hall why he liked the 'Antiquary' better than all his novels. A paper of Dr. Turnbull, Christie's, on Sicily, led Murchison to call me up, and I had the field much to myself. I told you that a temporary cloud came over me in Edinburgh at seeing the controversial storm gathering against me in the horizon; but I must say it was dispelled by this meeting, for never on the first meeting, after my first volume appeared, did I hear it so much spoken of. Fitton declared to the meeting his conviction that my theory of earthquakes would ultimately prevail. Greenough made one of his ultra-sceptical speeches, saying that once he only doubted what 'stratification' meant, but now he was quite at a loss to conceive the meaning of the term 'sea' in geology, and he thought no one could explain what 'the sea' meant. Fitton gave him some hard hits for thus fighting shadows, and 'assisting the cause of darkness' by doubting elementary truths. Basil Hall, with more humour, said as a sailor, that he felt alarmed at hearing the existence of a great mass of waters (for he would no longer give offence by talking of 'the sea') called in question, &c. He then eulogised my book, and after the meeting two American gentlemen came up to be introduced, and poured out a most flattering comment on its popularity in the United States; but what was much more to the purpose than this sort of incense, they gave me many facts bearing on my theories respecting part of North America. I did not get back till near one, and then a great fire in Holborn, which was too grand a sight to lose, detained me three-quarters of an hour.

2 *Raymond Buildings, Gray's Inn: November* 5, 1831.—After a good morning's work, I went with Lonsdale [1] to see

[1] William Lonsdale, b. 1794, d. 1861, assistant secretary and curator of the Geological Society. 'To no one man has our body been more indebted,

the panoramas of Quebec and Bombay, and instead of recreation got into a long argument with him. He took up the cudgels in favour of Elie de Beaumont and Sedgwick, but I made him abandon some points and doubt on all the rest. I returned to work, but after this went by invitation to drink tea with the Murchisons, and was thus kept to geology till half-past eleven o'clock at night, so that after my work this morning I found my head ache, and thought to relieve myself by going up to Dr. Horsfield,[2] who lives over me, to see his insects, which he studies every Saturday. Here I was excited again, for the Doctor was just returned from Leyden, and told me that he found Reinward (Professor of Zoology, I believe) just publishing a grand work in Dutch on the East Indian Archipelago, with a geological introduction, in which he declares his entire adherence to all my 'Principles,' and illustrates them by facts of recent elevation, &c., such as, Horsfield says, will startle all but me. Now you must know that Horsfield is one of those heretics of whose conversion I never had any hope, so I was amused at the pains he had taken to shake Reinward from the true faith, but all in vain. As Horsfield has a prodigious opinion of Reinward, and as he has that natural turn for philosophical pursuits that renders a person somewhat restless when in a state of doubt as to the explanation of grand phenomena, he has been reading Leonhard and other works to strengthen himself in his old faith, and declared himself still an unbeliever, though he wants amazingly to read my second volume. You will be glad to hear that your knowledge of Dutch will be so useful to me by-and-by. Mrs. Murchison was in high spirits, and has evidently enjoyed their tour,[3] and above all the York meeting. Her

whether for his publications, his conduct of our affairs, or the zealous and disinterested labour he bestowed in aiding and improving the works of his associates.'—Leonard Horner, *Geological Society's Proceedings.*

[2] Dr. Thomas Horsfield, F.R.S., b. 1773, d. 1859. For some years keeper of the Museum of the East India Company. His contributions to entomology and other branches of zoology are well known.

[3] During this expedition Mr. Murchison discovered that the Upper Silurian rocks (then called Upper Grauwacke) were stratigraphically conformable with the lowest members of the Old Red Sandstone formation, and that its different beds could be recognised from their containing peculiar fossils. Murchison here laid the foundation for his great work on the Silurian system.

real delight in conchology is of great use to her in taking away the tedium of long sojourns in out-of-the-way places, and she had a fair opportunity of collecting. They have found *recent* Irish Channel shells in abundance, 300 feet high on the Lancashire coast! I am delighted, because the identity of the living species of plants and animals in England and Ireland made me argue that some great changes in the distribution of land and sea had taken place in that part within the modern era. It is clear to me that the muster of nobles, dignitaries of the Church, and scientific men at York, must have done great good. A hundred and fifty ladies, and many of rank, at the evening discussions, must also have 'popularised' scientific pursuits. Lord Morpeth seems to have acquitted himself with great ability. Murchison made a capital cruise in the geological way. It is cheering to see how unabated his ardour is.

On his hearing from me how much your father was geologising, he has determined to write to him some hints about the geology of Düsseldorf, Cologne, &c., and to point out some things to be cleared up. The satisfaction he expressed at hearing that your father was so employed, amused me. He said very truly that a succinct account of what the Germans have done about that country would be a most acceptable boon to us here.

November 12.—This morning I wrote to Whewell, to ask him if he would review me, as Lockhart wishes, in the 'Quarterly.' Murchison has read the first three chapters, and liked them much. Necker of Geneva, Murchison, and Lonsdale breakfasted here. Necker expressed great regard for your father, and inquired about you all. I wish much that we may be able to pay a visit to him (in Switzerland), and I think he would put me in the best way of seeing parts of the Alps, where he thinks Elie de Beaumont's grand theory may be put to the test, and where he thinks it fails most entirely. Chamouni, moreover, is the grandest thing in Europe, and I should like you to see that.

King's College is in good odour. My friend Dodd, author of 'Autumn on the Rhine,' who declined a chair of English literature as unprofessional, he being a barrister in practice, is trying to get a chair of common law made. I want the

accession of a man like Dodd, who would strengthen the gentlemanly tone of the thing, as that is of more importance even than talent, to success.

Lord Lansdowne told Murchison yesterday that he had spelt my first volume from beginning to end in his late tour.

November 17.—We had yesterday an excellent meeting, both at the Club of the Geological Society and at Somerset House. A paper of Count Montlosier on Somma and Vesuvius excited much interest; we had a famous discussion. Buckland, Greenough, Fitton, De la Bêche, and I began, but Necker, on being invited, spoke half an hour most capitally. I never heard a better lecture. Otter, on seeing me at King's College yesterday, when I looked in after Geological Council, said, 'I am glad to see that you show your face here sometimes.' He looks very ill; he is probably too old for such a work as starting an university, though all has gone on quietly. There was a discussion at our end of the table about the costume of the King's College *students*, some saying that they ought not to have adopted the gown and cap, and others defending. As for the Professors, they all wear their own *gowns*, that is to say, according to the academical degree they may happen to have. Thus I shall have my Oxford Master of Arts gown; some have their Bachelor of Divinity; in short, the robes are as varied as at College of old.

Mrs. Somerville is returned. I have not seen her. Wollaston says she is looking ill, and attributes it to her anxiety about Greig,[4] who is recovering from a dangerous illness. Buckland is, I think, in pretty good spirits, though certainly very gloomy at times, and croaking about the state of the country. So are Stokes, Broderip, and many others. A feeling of insecurity of property has much lessened the demand for labour. Lockhart says that an additional stagnation of six months would make every bookseller bankrupt, except Longman and Murray; but this, I suppose, is a little too strong. As for public affairs, I have long left off troubling myself about them, as knowing that one engaged in scientific pursuits has as little to do with them in point of influencing

[4] Woronzow Greig, her son by her former marriage.

their career, as with the government of the hurricanes or earthly motion; and if one becomes annoyed, there is an end of steady work. Even Whewell is frightened about the Reform Bill.

London: November 20.—We had a most agreeable muster at Stokes's ordinary this morning, at which Buckland, Brown, Basil Hall, Broderip and I were at breakfast. All of a sudden I took it into my head to go and dine at Chelsea, if I found Mrs. Somerville well enough. Seeing her book on the table led me to think of this, which I had before resolved not to do, till I knew she was better. Found Stokes going to Athenæum, who agreed to go on to Chelsea, if I would stop at the club ten minutes. Crawfurd there fastened on me, and told me about a book on India, which he is coming out with, and of a geological chapter he wishes to write. On our way we looked in to see Chantrey's fine statue of Canning. Is it not provoking, that just after Chantrey has built a most splendid and truly elegant house, Lord Grosvenor's agent has persisted in building just opposite, in spite of remonstrances, a vile, tall steam-engine chimney! 'Tis enough to sour any one for the rest of his days, but Chantrey is luckily not atrabilious. I found Mrs. Somerville quite glad to get me to dine there, and I spent a most pleasant evening, and stayed very late. All kinds of offers from her and the girls, to be useful to me in getting up my lectures. Mrs. Somerville is looking oldish. I think the book has done her no good, and when I see it, I am sure that such a work must have been too great an effort for any one in the time. It was a gigantic undertaking. Babbage was offered knighthood, but declined, not as underrating it, but because he had written on the necessity of titles being given, &c., and it would look ill if it appeared that he had done so for personal considerations. Martha and Mary S. have made a beautiful collection of seaweeds at Bognor.

November 22.—I have been this evening with Necker, who will, I hope, on his return from Aberdeen, visit Kinnordy. He has been planning an expedition to Chamouni and the Vallorsine for us; and as all the points, some of the most picturesque, as well as geological of the Alps, which I ought most to see, are the same to which he took his mother, an

oldish woman. last year, it is clear that you can go to them. Talking over Chamouni has revived my admiration for that region, to which all the rest of Europe which I have seen is poor in comparison, for grandeur and sublimity of scenery. Somerville was remarking that De la Bêche's book is unintelligible, and that I must write an introduction, which I told him I intended to do. Anticipating a small class, I have been thinking that the only way to ensure my not letting down my reputation in my lectures is to determine to write so many chapters for an easy introductory volume. You cannot think how much my spirits have risen, so far as the lectures are concerned, since I saw more clearly than formerly how easy they will be. Somerville's wine and coffee, and the excitement of walking home with Stokes, who kindly volunteered entering on what my introductory lecture ought to be upon, made my head ache, and I hardly got any sleep, and am almost good for nothing to-day. Mrs. Somerville begged me to send a copy of her book to Bonn, which is going in the parcel to Von Oeynhausen.

December 2.—I had a hard task yesterday to keep my resolutions of severe temperance, for Murchison was so unwell, that he asked me to preside at the Geological Society club dinner, and take his friend Colin Mackenzie to it; so I was obliged to push about the bottle, and to sham taking a fair quantity of wine. Our numbers were thinned by the Royal Society Anniversary and by the rain, bnt it went off well, and in the evening brilliantly. A sort of geographical paper, long and dull, and really of no value whatever, was to have been read by my travelling companion Captain Cooke, now again in Spain. We had staved it off till we had read out the others. But when your father's letter to the President came about the new isle north-east of Pantellaria,[5] we determined to shove Cooke's into the coal-hole without ceremony. So when Turner had read some passages, Murchison (for he was recovered enough to take the chair) said to the meeting 'that it would not be doing justice to Captain Cooke to go on, since there were certain maps and illustrations which ought to accompany, not yet arrived: that it was begun, just that it might keep its place, &c. I then

[5] Graham Island, visited by M. Hoffmann, the Prussian geologist.

officiated as secretary, Broderip being ill, and read Hoffman's paper,[6] which produced an animated discussion, into which I entered largely. The structure of Pantellaria, the wasting away of the new isle, the par-boiled fish, the floating cinders, the clefts at Sciacca, &c., all afforded subjects for Fitton, myself, De la Bêche, Dr. Babington, Murchison, and others to dilate upon. The President was knocked up by his extreme imprudence. He went to dine with thirty other F.R.S.s at Kensington, with H.R.H.,[7] and came home with Captain Smyth, who seduced him to a smoking bout till three o'clock next morning! punch I believe accompanying. He was half dead at the council. This morning he persuaded me to go in his carriage with him to see the Œningen freshwater tortoise (*achelonia*) which Bell, the dentist, has got over for his museum. After the paper of Hoffman's was over, old Whishaw came up to me and said 'he never heard one more interesting, and he thought Horner had drawn it up with great clearness and judgment.' He and Fitton mentioned having received letters from your father. I told Murchison long ago that I meant to dedicate vol. ii. to him, not only as President of the Geological Society, but because I use our joint and unpublished notes on Auvergne in the volume, and because we had together part of the best and longest geological tour which I ever made, my tour which made me what I am in theoretical geology, or completed my views on that. Scrope came here this morning, full of the frightful state of the country. For my part I am, in regard to politics, in the happy condition of Voltaire's gardener: 'Travailler sans raisonner, c'est le seul moyen d'être heureux.'

December 6, 1831.—A letter from Whewell, expressing his delight at my three hundred pages, and that he had actually begun a review of me for Q. R., excited me to work with spirit; and after two days thinking of the delay which the completing the subject in one volume more would occasion to the getting out the large part already done, I resolved to see if I could get it out as a volume by itself. Told Broderip I should dedicate it to him. He was more overjoyed than I

[6] Drawn up for the Geological Society by Mr. Horner.

[7] The Duke of Sussex, President of the Royal Society.

have seen him many a day, and the day after he declared that if a legacy of 5,000*l.* had been left him, it would have given him less pleasure. So I must explain to Murchison that the third volume is the one he ought to have dedicated to him, as it is the part in which he is strong, and where his name will appear.

December 9, 1831.—I am just returned from a very late sitting of the Royal Society, at which the President's (the Duke of Sussex) speech was read. It touched on very delicate ground, his election, and his conception of his duties, and why he thought himself fit for the office. Yet there is really not a word that one could wish altered. It raises him much in our estimation, and I know few public men who in so delicate and personal an affair could have acquitted themselves so well. His allusion to Herschel and his father was excellent. 'Sir John Herschel, to whom I had the honour, for I cannot call it the misfortune, to be opposed.' When I get the annals or proceedings of R. S. I will send them. You will read the Duke's speech with interest, if you have ever heard of the feuds and schisms which our contested election gave rise to. I was quite amused to find, from conversation with Whewell last night, how much his tone is altered in regard to my anti-catastrophe system. I am sure that, when volume three is out, there will be few of the paroxysmal school left—comparatively few—and they will be far more moderate.

December 12, 1831.—Dawson Turner was at Athenæum last night, with whom I had some talk; also two good hours' confab with Scrope, who has a most active intellectual mind—alive to everything, politics, political economy, Hume, Berkeley and Reid's metaphysics, geology, Irving, the Roweites, and progress of fanaticism. I went this morning to thank Otter for a volume of Horsley's sermons, one of which on the discrepancy of Genesis with certain philosophical discoveries is very striking, and perhaps the most straightforward, manly, and to-the-point declaration that any eminent divine has made.

December 13.—The Athenæum was very entertaining last night, so many members of the honourable House coming there, after the new Reform Bill was moved, and giving their

opinions *pro* and *con*. I went to call on Mrs. Lockhart, who is expecting to lose her eldest boy, poor 'little John,' every day. I made a great blunder in missing the Geographical Society last night, through forgetfulness, where I should have got some sound information, instead of hearing politicians discuss the interminable bill. Young said, 'Scrope, nothing will please you, because you are a philosopher half a century in advance of your age, who wants to Owenise the representation, and divide the constituency of the country into parallelograms.' We all laughed at the sally of the old beau, for it hit my friend hard. You will like Scrope, I am sure, very much. Dined at the Geological Society club. Majendie, the famous French physiologist, sent by the Institute to Sunderland about cholera, dined with us. He complains of the public hospital. Agrees well with the opinion which you sent me about Mittau, that in general the less you do, the more you leave it to nature, the better. A pleasant club. Stokes, Greenough, Buckland, Lord Cole, Broderip, and a few more. Murchison was pheasant-shooting in the country, but cut in for the meeting. A short paper on Springs, and another by Mr. Hutton on the Whin Sill of Yorkshire, drew up Buckland, Greenough, Fitton, Murchison, and De la Bêche; and as they seemed much disposed to go on for ever, Buckland speaking five times, but not once too often, I was glad to sit quiet, having held forth at such length on the new isle, &c., last time. Mrs. Somerville has just sent me the most peremptory mandate I ever received from her, to come there next Sunday. I know not who is to be there. I was sorry to miss the Brahmin Ramahoun Roy last week. Went to Beaufort at Admiralty, to go over a new map, showing modern and ancient coast line of Adriatic.

Sunday.—Went with Stokes and Broderip to look over the splendid collection of South American shells brought home by Cuming.

Jermyns:[8] *December* 24, 1831.—I found them here all quite well yesterday, and Marianne and Caroline looking really quite blooming and happy and pretty. We are just going out for a walk together. I have announced to them my decided wish to get free of the professorial chair, and at the same

[8] Near Romsey, Hants.

time recommended my aunt to send cousin Gilbert to King's College, to prepare him for Cambridge. The examination of the forty-one mathematical and classical students, and the various lectures of Hall, Austin, and Otter, have given me an exceedingly high idea of the general education system at King's College, and I am certain that when once it is known the increase will be very great. There is emulation, a genteel set of youths, most of them going to Oxford and Cambridge, and three elegant scholars and gentlemen. Conybeare was at the Royal Society on Thursday. On my hinting that I should probably get free from King's College next spring (you remember the move he made towards my getting the chair), he was almost sore, and said he trusted I should think better of it, that it was a fine position, &c. The fact is, Conybeare's notion of these things is what the English public have not yet come up to; which, if they had, the geological professorship in London would be a worthy aim for any man's ambition, whereas it is now one that the multitude would rather wonder at one's accepting.

Christmas Day.—Marianne, Carry, and I went to Hursley Church, a long service, and it was a frost, and the church not over warm. What you say of the Lutheran equality is certainly a striking contrast to that most aristocratic form of Christianity which has been established in England. Gibbon Wakefield says in his pamphlet, amongst a long list of causes which make the poor feel an aversion to the higher classes: 'Even in church, where some of them preach that all are equal, they sit on cushions, boarded, matted, and sheltered from the wind and the vulgar gaze, whilst the lower order must put up with a bare bench or a stone floor, which is good enough for them.' We got out of the carriage when we were half way back, about two miles, when we got into fine forest scenery, so we had a delightful walk on the fine gravel road, and a bright sunny frosty day. Just as we were going to dine, the children raised a shout of 'Tom, I declare!' and a gig drove up. Great was my surprise to find that it was my own brother Tom, whose ship had come yesterday from the Downs to Portsmouth, who, finding himself within three and a half hours' drive of Jermyns, had just had time to get leave, boat it ashore, hire a gig, and

cut in for our five o'clock Christmas dinner. My aunt was quite overjoyed, and we had a very merry, cheerful evening. I shall stay to-morrow and return on Tuesday, and be thoroughly idle all the time. Eleanor says 'Fanny had a cheerful letter from Harry. He says he never had been in such good health since he had been in India. The regiment was stationed at Secrora, in the province of Oude, one of the very best stations in India, and he was thinking of not taking his furlough till they left that, which would make up his twelve years. We are going a long walk, and Marianne has proposed taking me on this fine frosty day to see where 'the chalk hills' join the sands, &c., which this house is on.

London: December 29, 1831.—A letter from Murchison, concurring most warmly in the propriety of my cutting King's College after the first course. 'I look to you as my successor as President of the Geological Society. I wish Phillips may become Professor of Geology at King's College. Touching the book, I quite approve of your dedicating this part to Broderip, but I shall be not a little mortified if any delay, whether caused by *devils* or *angels*, should retard the publication of the third part beyond my consulate, inasmuch as I had in the pride of my heart calculated (after what you told me) on this dedication, as marking an epoch in my life, of which I am justly proud, by the distinction of all others most flattering to me, this tribute from my colleague and friend.' Another letter was from Whewell, followed the day after by his review of my book. Though it is not so spirited in style, nor so rich in thought and original matter as that in the 'British Critic,'[9] it is very good, enters completely into my conception of the subject, sees the bearing of the whole on geology, and explains it in a clear way. Sir Walter Scott's health improved on his voyage to Malta, but they fêted him there too much, and he has rather relapsed. Mrs. Lockhart is quite overcome at the loss of little John, and sees no one.

December 31, 1831.—I have been walking back from Hampstead on a fine frosty night. I feel quite at home at

[9] Review in *British Critic* on the *Principles of Geology*, vol. i., by the Rev. William Whewell.

24 Church Row.[1] Mrs. Mallet says, 'I am afraid if you do not retain your Professor's chair you will not live in London by-and-by.' I said it was partly a fear of that, that first induced me to court some official place, which should oblige me to be in the metropolis of science, for I dreaded it becoming prudent to live elsewhere, which I knew would be giving up my career for ever. I talked with them already over the *pros* and *cons* like old friends. What a cheerful countenance hers is! there is such a happy look, as may gladden any one who talks with her.

If I could secure a handsome profit in my work, I should feel more free from all responsibility in cutting my cables at King's College. Do not think that my views in regard to science are taking a money-making, mercantile turn. What I want is, to secure the power of commanding *time* to advance my knowledge and fame, and at the same time to feel that in so doing I am not abandoning the interests of my family, and earning something more substantial than fame. I am never so happy as when at the end of a week I feel I have employed every day in a manner that will tell to the rest of my life, and last week will, I think, be one of them.

[1] Residence of John Lewis Mallet, Esq.

CHAPTER XV.

JANUARY–MAY 1832.

CONVERSATION WITH BABBAGE—MRS. LOCKHART—VISIT TO DR. FITTON AT HENDON—DINNER AT MR. MALLET'S AT HAMPSTEAD—ENTOMOLOGY—ANNIVERSARY DINNER OF THE GEOLOGICAL SOCIETY—PARTY AT MURCHISON'S—SEDGWICK DECLINES A LIVING—CAPTAIN BASIL HALL—ZOOLOGICAL FARM AT KINGSTON HILL—BUTTERFLIES—ON RELIGIOUS TOLERATION—LECTURES AT KING'S COLLEGE—REFORM BILL.

[In January 1832 the second volume of the 'Principles' was published, and a new edition of the first volume, which was already out of print. In this year he married, and made a tour up the valley of the Rhine, and visited the Valorsine on his way home through Switzerland.

In 1833 he gave lectures at the Royal Institution, and revisited the Rhine and Bavaria.

He received the gold medal from the Royal Society for his work on the 'Principles of Geology.']

JOURNAL.

January 6, 1832.—I am writing in an unaccustomed place, the room in which Babbage's celebrated machine is constructing—Southwark; for having met him, he proposed to me to take a walk here, and has left me while he transacts business. He said, 'I am going to give a course of lectures at Cambridge.' 'How many?' 'Four.' 'I thought you told me it was loss of time.' 'So I did; but I am coming out with a pamphlet on the Political Economy of Machinery, and I mean to discharge it first in a lecture. I would not have gone through the work that these four have cost me, for many times my professional income.' He said that he would advise me to try a course of lectures before I judged of the degree of interruption they would give me—that he

believed the council of King's College would be glad to retain me, even if I would only agree to give six lectures in the year. As Fitton strongly recommended me not to give it up so long as they permit me to do as I like, I incline at present to give Otter notice by-and-by that I will not lecture next autumn, and that I shall probably not lecture till after Easter next year, and must be at liberty then to give as few lectures as I like. My second volume is to be laid upon the table of the Geological Society this evening.

I went by appointment to Greenough's, Regent's Park, to get instructions respecting a recent formation examined by his friend J. Burton on the shores of the Red Sea. On my return I called on the Lockharts, and after a confab with him, I went up to her. She was looking much worn by anxiety, but I never saw her appear to greater advantage. She brought down 'baby,' a child of four years old, who broke her arm the other day—getting on very well. I heard a long description of the accident. She showed me an ode of ten lines written by Wordsworth on her father's leaving England, in the highest strain of poetry and very original. I shall try to get a copy some day, as it would delight you. Another longer ode by the same, on the same subject, was good, but in a commoner style and lighter strain. Just as I was going, 'Conversation Sharp' came in. He began to rail against Clubs. 'Well,' said Mrs. Lockhart, 'I don't know what I should do without the Athenæum. Lockhart is never so entertaining as the days he looks in there, and that is five times a week, but I don't let him stay there long.' I have been getting on to-day pretty fairly. Babbage and Fitton were so delighted at seeing my volume dedicated to a private friend, instead of some great man, that in the effusion of their feeling of friendship for Broderip, and their anti-aristocratic spirit of independence, they came up, and each shook me by the hand, saying, 'I am as much obliged to you as if you had done me a favour.'

London: January 7, 1832.—I received a letter from Tom this morning, sent when he was just sailing. I shall do all I can steadily for him, but poor fellow he has small chance. A better officer or man never lived, or who has roughed it more, from being shipwrecked when nearly all were lost, to

every description of tyranny in the captain. His present one is so violent that he has broken more than one five-guinea telescope on the *heads* of the sailors, and sworn at his first lieutenant before the crew. His health suffered in such a manner on that vile African station, that I dread the West Indies.

I am very fully persuaded of one part of Mr. Cockburn's advice to you—to marry one who earned his bread by his labour. At least I am sure, that unless I can feel that I am working to some decided end, such as that of fame, money, or partly both, I cannot be quite happy, or cannot feel a stimulus to that strenuous application without which I should not remain content. I am told by most authors that, though slow work at first, yet, with a name, one can command the booksellers. I certainly feel that my power is increasing, though slowly. I fancy that if I am allowed to do little for several years, I shall by degrees get up a course of respectable length without much fatigue or loss of time; and knowing, as I do, that it is a science that is only beginning to unfold its wonders, I hope to continue it always. If I can only earn some cash to enable us to travel, it will be a grand point for both of us. I propose this summer to go up the Rhine to Basle, see the Falls of Schaffhausen, then north of Switzerland or a peep at it, then Chamouni, and take a run over the Simplon, returning perhaps by Mont Cenis or some other pass.

Mill Hill, Hendon: Sunday.—I came by coach to this place after breakfast, passing through Hampstead. Dr. Fitton is residing here, at Mr. Wilberforce's house, a most delightful residence, eleven miles from London. Mrs. Fitton and children quite well; six children. Conybeare and Babbage the only visitors; most agreeable; but not lying *fallow*. Fitton pronounces me to be rather thin. We have had great fun in laughing at Babbage, who unconsciously jokes and reasons in high mathematics, talks of the 'algebraic equation' of such a one's character, in regard to the truth of his stories, &c. I remarked that the paint of Fitton's house would not stand, on which Babbage said, 'No; painting a house outside is calculating by the Index minus one,' or some such phrase, which made us stare; so

that he said gravely, by way of explanation, 'That is to say, I am assuming *revenue* to be a *function*.' All this without pedantry, and he bears being well quizzed for it. He says that when the reform is carried he hopes to be 'the secularised Bishop of Winchester.' They were speculating on what we should do if we were suddenly put down upon the planet Saturn. Babbage said, 'You, Mr. Lendon (the clergyman there, and schoolmaster, and a scholar), would set about persuading them that some language disused in Saturn for 2,000 years was the only thing worth learning; and you, Conybeare, would try to bamboozle them into a belief that it was to *their interest* to feed you for doing nothing!'

Fitton's carriage brought us from Highwood House (the correct name of his place) to within a mile of Hampstead, and then Babbage and I got out and preferred walking. Although most enjoyable, yet the staying up till half-past one with three such men, and the continual pelting of new ideas, was anything but a day of rest. We were disputing sometimes on difficult scientific questions, sometimes on other topics, Tom Moore's poetry, to wit. I cannot recollect Conybeare's favourite lines, but it is where Moore says to his country that his songs on Ireland are not his, but, like 'the breeze, they wake the magic that is all thine own.' Babbage thought the Irish melodies superior to all the rest, in which I agree, and Fitton cited these lines:—

> When midst the gay I meet
> Those gentle smiles of thine,
> Though still on me they turn most sweet,
> I scarce can call them mine.
> But when to me alone
> Your secret tears you show,
> Oh, then I feel them all my own,
> And claim them as they flow.

I am not the better for drinking hock or Rhine wine there 'to our friends on the Rhine.' I was as temperate as the rest, but that is not saying much.

January 13, 1832.—Mrs. Mallet thinks your mother the most exemplary person she ever met with, for making the best of everything, and not giving way at difficulties; and admires much the courage with which she set out to Bonn

without Mr. Horner, in which I fully concur. I hope we shall both of us contrive to cultivate a disposition—which David Hume said was better than a fortune of 1,000*l.* a year -- to look on the bright side of things. I think I shall, and believe you will.

Fitton tells me that they had serious thoughts of putting me out of the Council, in order to give me the Wollaston medal, but I am glad that this subterfuge is avoided. Besides, I would rather avoid at present anything so invidious as a prize, and it would be against the spirit of Wollaston's bequest. I went to Lockhart's, and on a solicitor coming in on business, I went up to Mrs. Lockhart. After an account of her visit last week with the children to the Horticultural Garden, I said: 'If you had not been there so lately, we might have gone together to-day.' 'Can you take me in on a Sunday?' 'Yes.' 'Well, then, I'll go again: it will be a nice walk this frosty day. Lockhart is going with Mr. Murchison to see some pictures, and we will go to the garden, and if you can take two ladies, I will ask Miss Alexander to accompany us.' So I marched off with my two ladies, and they were much pleased. Indeed the gardens are much improved and enlarged in the last five months. *Baby's* arm is going on well. At Chelsea I found Somerville just recovering from a touch of the gout. They were right glad to see me after three weeks' non-intercourse. I took in my pocket a volume of my work, but found that Dr. Somerville had read it right through, and made notes on it. She is looking well, and so are the girls. A walk home in a bright moonlight did me much good. I looked in at the Athenæum on my return, to see if any companion was there, and I found Stokes just ready to walk home with me. I forgot to mention, among my lucubrations, calling on Scharf and seeing a fine piece of scene-painting which he has done of my panorama of Val del Bove on Etna (nine feet long) for King's College lectures, and other scenic decorations.

Monday.—Whewell called, and is going greatly to improve the review. Murchison had pointed out that Omalius d'Halloy had based part of his new 'Elements of Geology' on the Lamarckian transmutation system, more than a justification of my having expended so much powder and

shot upon it, though I did not see O.'s work till I had written my first half. As O. thinks man existed at the old coal epoch, and finds authority for it in Genesis, I expect Whewell will give him the lash.

Mrs. Somerville showed me an interesting letter from Ivory, written on receiving her book. He says astronomy has gone as far as it can in certain lines, till a new mode of calculating is invented, and that may be done.

London: Tuesday, January 17, 1832.—Sedgwick met me to-day, and carried me to his lodging, to show me his maps made last year, and his summer's work. 'After you and the Oxonians left us, I was kept in Cambridge by a parcel of old women, who came there on a visit. What think you! Phillips, R.A., wants me to sit for my picture. Maiden blushes suffuse my cheeks: very handsome, no doubt, to paint me for nothing, and he says I look best in a black stock. Very dry work geologising in Wales, all primary and old rocks, like rubbing yourself against a grinding stone.'

Henslow was at Linnæan. He sent us a beautiful paper on a hybrid foxglove, with plates published in Cambridge Transactions, the excellence of which cries shame to Oxford, which is so far behind, that they cannot attempt to get up Transactions on Physical Science.

Thursday, 19.—Went to the Council. Warburton, Sedgwick, Conybeare, Basil Hall, Murchison, Clift, Broderip, John Taylor, Turner, Fitton, Greenough. A grand discussion upon the Wollaston medal, and it ended by an admirable resolution that 'this year's dividend of the Wollaston fund should be paid to Lonsdale, to assist him in continuing his survey of the oolite of England.' We must force him to undertake field work, or his health will entirely give way, and he is so good an observer, that it is a sin to chain him to clerk's work and museum arranging. We had a very full meeting at the Geological Society, Henslow being there, and his famous paper on Anglesea incidentally alluded to, Conybeare got up, and quoted some lines from Pindar on the feats of the infant Hercules, as he observed that Henslow's first paper was such a masterpiece. At which 'the first of men' rose, and begged to observe, that as mythological allusions were introduced, he must inform them that

Henslow was making his first tour with *him*, his master in geology, when he went off on that expedition ; so that, like Minerva, he had sprung full-armed from the head of Jove !

January 24.—A letter from Captain Cooke, R.N., from Madrid, dated December 1830. He has been geologising until laid up by a kick from his mule. Government there more civil to strangers, but robberies increase.

January 25.—I went to Royal Society last night, the fullest and best attended meeting since the Duke was President : he was not there. Conybeare introduced me to Dr. Pritchard, whom I have cited and eulogised. Chantrey said, ' Lyell, I've not seen you an age. I congratulate you on your new birth, and on being unlike so many of my friends in not looking older for your hard work.' Wollaston said he had read to Chapter Thirteen, and was going on most diligently. I have not had so many pats on the back I don't know when. I had a very good day's work yesterday. I think I never do so much as when I have fought a battle not to go out. The way to do much and not grow old, is to be moderate in going out, to work a few hours or half-hours at a time, to have nothing but a pot of porter and a chop the days you do not feast, and to go to bed at eleven o'clock. But, above all things, to keep out of the excitement of politics, which is now raging like a high fever here.

CORRESPONDENCE.

To Gideon Mantell, Esq.

January 18, 1832.

My dear Friend,—Sedgwick is in town, and has been rather, I should say, wasting his giant strength on a barren primary district in Wales, which he owns was like ' rubbing himself against a grindstone.' Conybeare is here, and in good feather and spirits, but does not seem to have made much progress in his promised work on Geology. Henslow is to be at the meeting to-night, so I much wish we could see you amongst us. Buckland has also promised to come up.

They say he will give us the Cave book soon, but I shall believe it when I see it. Two or three pages of green sand fell through Fitton's hour-g'ass, and then to be positively

talking of giving it up till next vol.! after printing something. How lucky your chalk tables came out! Buckland is reported to have said to his wife, when she asked him what he should do for the Bridgewater prize of 1,000*l*, 'Why, my dear, if I print my lectures with a sermon at the end, it will be quite the thing.'

I am working hard in the hope of getting out vol. iii. before I go abroad, for if I do not, I suppose it will not see the light in a great hurry. Ever most truly yours,

CHARLES LYELL.

JOURNAL.

To MISS HORNER.

London: February 2, 1832.—At the Somervilles' on Tuesday. They were remarking that it was odd that Chantrey and Stokes, and Brown the botanist, and Troughton the optician, and one or two more whom I forget, are all blind of one eye. Mrs. Somerville had nearly finished another volume. I fear that it can hardly sell, because, Sedgwick says, so few men at Cambridge can go far enough to enter into it. He proposed to the Philosophical Society of Cambridge to elect her, by acclamation, member on receipt of the book, but some objected to the manner of doing it. Sedgwick says: 'It is most decidedly the most remarkable work published by any woman since the revival of learning.'

February 3.—Just returned from the Geological Society, having dined at the club, and since taken an active part in a debate, with Sedgwick, Conybeare, De la Bêche, Fitton, Greenough, and others—which was prolonged unusually till half-past ten o'clock—'on the old and new red sandstone,' and other dryish subjects, which Adam made entertaining. The paper was by him. The attendance was quite splendid, very numerous, and all the best men there.

February 4.—To-morrow I expect an agreeable breakfast at Stokes's. Captain Hewett is to go there with me, an R.N. surveyor, who has been collecting according to my instructions in the North Sea, and wants a lesson from Stokes. Murchison is to call here on his way, and to talk over some sections for a chapter of mine on 'the crag,' one of which I

think of borrowing from his last year's note-book. Captain Hewett called, and went with me to Stokes's, where we met Brown, Murchison, and Captain King. Both the naval men gave me many valuable facts in regard to tides, currents, &c. Hewett has been reading all the *nautical* or hydrographical parts of my first volume with a critical spirit, and will help to correct and amplify for second edition. After breakfast Murchison came to my rooms to talk over his speech, and go over on a map my intended tour with you. He stayed long, and I thought it impossible to get to Hampstead, but I thought I would try, and they had not sat down to dinner. The party were Dr. and Miss Yellolay, M. Prévost, Mr. Martin, Mr. Merivale. I thought Yellolay very agreeable. He spoke with delight of the last meeting of the Geological, and talked of the early days of the Geological in Lincoln's Inn Fields, when he and Horner and Laird were working together, and when the Medico-Chirurgical Society shared apartments with the Geological. He supposed that Mr. Horner was now cultivating his old hobby at Bonn, desired to be particularly remembered to him, and recurred with enthusiasm as we came home to the old times, and to Francis Horner, &c. I was much pleased to hear Mrs. Mallet talk with such amazing delight of the geological lectures which some time ago Webster delivered at Hampstead. She tells me she could think of nothing else for a time but geology, and that she has drawings now from recollections made as notes to those lectures, which she is to show me some day.

I have been so wishing that your father was within reach, for I would give him the rough copy of my chapters in MS., and I should be so much benefited by his aid. Brown has invited me to read some notes and corrections he has made: this is all one can get from him. He will not help one to any general views, but if you blunder at all in facts, he will correct you.

February 10, 1832.—I am just returned from the Murchisons. My favourite, Mrs. Lockhart, was there. She told me she had been desperately alarmed for two whole days, the little dog Spicey having been missing. We are going together on Friday with the children to the museum in

Bruton Street. Mr. and Mrs. Conybeare, I had not seen her for many years, ten I think. She is looking well. Mrs. Lockhart told me that Hogg was much fêted, and told her he was *dennered on* for the end of the month, if the grand *denners* did not kill him first. I took a very small box of insects taken last year at Kinnordy to the Linnæan Society, and you would have been amused at the sensation created by a pair of beetles from Catlaw, our highest Grampian near Kinnordy. They proved new, and belonged to a favourite family (the *carabidæ*) of a favourite order with all entomologists (the *coleoptera*). But I will not trouble you with a long account of this most *glorious* discovery, of which I have already written a full despatch to Eleanor. Mrs. Mallet has certainly a considerable turn for natural history, for she is reading my book with more eagerness than most of my friends. Have just returned from Royal Society, where a paper by my friend Captain Smyth was read, proving that the new isle did not rise on, or near *the shoal*, but in water one hundred fathoms deep. So that Prévost's elevation crater is in the highest degree improbable or impossible, but there is nothing strange in a volcano seven hundred or eight hundred feet high.

Friday morning.—Captain Smyth[1] called immediately after breakfast, and cut up half my morning, which would have tried my temper, but for listening to what he had to say about the Royal Society, and having renewed by a coze of two hours an old acquaintance which I much prize. His letters from France have disgusted him with the manner in which the eminent scientific men have thrown up their pursuits, and turned place-hunters, even Arago. Smyth has an ardent love for science for its own sake, in which his wife sympathises most strongly, and I know no people who have less worldly-mindedness and low ambition, and real happiness and contentment with a small income. Yet it proves that there is no great decline of science in England, that Smyth has hardly been a *loser* even in a pecuniary point of view.

[1] Admiral Smyth, b. 1788, d. 1865. Distinguished for his able survey of the Mediterranean, and later on for his devotion to astronomical science. He erected an observatory at Bedford, and the accuracy of his observations won for him the gold medal of the Astronomical Society.

He might have been hydrographer, I am told, and the Admiralty voted him a sum of 500*l.*, I believe, for his astronomical observations.

February 13, 1832.—Young Murray tells me Mrs. Somerville's book does not sell at all, and that Brougham had made great professions, both to him and his father, of what he would do to push it, whereas he has not taken the slightest pains to help it. The surprising and fine part of the work is, that everything which she there shows she so perfectly knows, was acquired for mere pleasure, just as others read a poem. The State might award her 5,000*l.* for the benefit conferred by a woman who could thus teach what Johnson justly called 'the most overbearing of all aristocracies, that of mathematicians,' how most of them can be equalled and surpassed by a lady who was merely reading for her amusement. It is true that there is not much display of *inventive* power in the book—not that kind of power, for example, which enabled Babbage to invent his machine, but there is some I understand.

I expect that in the course of the next ten years the seeds which I have sown in regard to the action of modern causes will come up in an abundant crop, and stifle all the school who delight in what they call 'the *poetic* mystery' of geological causes. For I find every day the hydrographers are coming to me for instructions. I have just drawn up some for Captain Fitzroy, who has my book, and is surveying in South America. Captains Hewett, Beaufort, King, Vedal, and others, are in continual communication. There has been a little talk of getting a bust from Chantrey of Mrs. Somerville, to be put up in the Royal Society at their expense.

Mrs. Mallet showed me her *geological* drawings and sections, which are very well copied, and I am sure I could soon make her a geologist. I was regretting you were not staying with her when she attended Webster's lectures. She observed, 'When one has for a long time been remarking and wondering at a thing, as I had, at chalk and chalk flints at Margate, the first gleam one gets on such a subject is so highly interesting.' Now the fact is that most people are as a friend of Stokes said, who was bothered with people wondering at the comet in 1811, and talking of nothing

else. 'Why,' said he, 'have these people thought of the heavens for the first time? have they always *taken the stars for granted?*' Most people would take a chalk flint *for granted*, and if they had thought and doubted enough of what it could be to be delighted when told it was often a silicified sponge, it shows that they had minds apt for cultivating Natural History, and prone to inquire into 'the causes of things'—which people I believe are born with in very different degrees, not by any means in proportion to the talents they may happen to have for other pursuits.

Did I tell you that a Belfast Professor of Divinity, Edgar, has been denouncing an unfortunate Dr. Drummond, who gave lectures on geology in the Royal College there, for having declared that 'the changes proved with *tolerable certainty* by geology must have occupied time to which our historical eras were as nothing;' and then the Professor wrote to me, as Professor of King's College, to know if the lecturer or he was right, expressing great alarm for Christianity if such doctrines were true. I shall not go to Murchison's to-night, for I am getting round again, and will be very quiet, and to-morrow shall do a great day's work again.

February 19.—On Friday I went to the General Meeting and the Anniversary Dinner of the Geological Society, at the Crown and Anchor—a splendid meeting. Near the President sat Lords Milton, Morpeth, Cavendish; Sir John Malcolm, Sir J. Herschel, Sir J. Johnston, M.P., Sir R. Vyvyan, Sir C. Lemon, and other M.P.s. Literature represented by Hallam, Lockhart, Sotheby, &c. Geologicals—Buckland, Conybeare, Fitton, Greenough, Sedgwick. Then from Cambridge, Whewell, and many other good men. All the best geological residents in town. Murchison was ill, but got through the fatigue very respectably indeed. All the speeches were short, and many of them able. I was glad when mine was over, but Murchison made my reply easy, by giving me something to say off-hand, as he told them he should say nothing of my book till the evening; and I told them I should follow the President's example, in thinking that they would have enough of me if they heard of me once in a day. Hallam asked to be introduced, and talked of Bonn friends. Ferguson of Raith asked me to walk with

him from the tavern to Somerset House, and asked after you all. There were about one hundred and thirty at the dinner, and a hundred of them picked men. When I came up here on Wednesday morning, I found your father in town. He drank tea with me in the evening. The Royal Society has actually engaged Chantrey to make a bust of Mrs. Somerville—a very gracious proceeding—and they sent a deputation to communicate their wish that she would sit for it. At Cambridge, too, I am told it has been decided that it shall be a class-book. So I hope it will sell, though slowly, and certainly it will now be useful.

I heard this morning that Senior means to give up not only the chair of Political Economy at King's College, but to abandon the course of lectures he had promised—nine in number; his reason being that he is appointed Commissioner for inquiring into Irish Tithes, &c. I shall consider Senior's withdrawing as the loss of the man whom I had most satisfaction of being a colleague with, as one of known talent, and well known at Oxford.

March 16, 1832.—An excellent party at Murchison's last night—many at dinner, and the rest came early, and evidently to a thing they enjoyed—very *select*. 'The first of men, Adam,' *alias* Sedgwick; Mrs. Somerville, the first of women, not of the blue; Schlegel, Brewster (*now* Sir David), Babbage, Dr. Somerville, Conybeare; Lords Morpeth and Wentworth (Lord Milton's son), and Upton his tutor; Sir John Johnston, M.P. for Yorkshire, and his lady, who was a Miss Vernon Harcourt; a sister of hers, a very pretty lively girl. Sedgwick as usual was in rhapsodies with her, and talked to me of her all the way home.

I put my name down yesterday for two guineas to Mrs. Somerville's bust. About 80*l.* subscribed—200*l.* required. It will soon be filled up, and if not, Chantrey says he would happily put down the rest himself.

Murchison is one who has worked at science chiefly for the rewards, but not entirely, for if he had had no pleasure in it he would have failed. Sedgwick and Conybeare for the pleasure chiefly. What I shall always cherish, is a love for science, rather than its rewards; but I indulge the hope of profit, as the best earnest of usefulness, and also of protec-

tion against its becoming a duty to accept some offer of an uncongenial situation.

Dr. Wollaston and Mrs. Somerville, of whom I have seen much, were very useful in 'mortifying' in me much of the vanity which I formerly had, and I think they were two kindred minds, and ought to have been united. She has done a real service to science, by showing many who are proud of inferior achievements what can be done by one of no pretensions. Of course there are some who are jealous of the homage paid to her. I hear every week of some one who says: 'What has Mrs. Somerville done in the way of *invention*? what is she but an expounder of La Place?' I cannot judge of her inventive talents as displayed in this work, and I don't suppose she has exercised them, but she has worked in all that has been done since La Place, and doing that is an enormous work. Undoubtedly the highest honours are due to original discoveries and inventions, and nothing is so rare as inventive talent, which Wollaston for one possessed; but her introduction proves she has it, and how little hers has been called into action! At least there are not five persons in this country that could have written her book, if that number.

Sedgwick has declined a living of 1,100*l.* a year offered by Brougham, on the ground of not being able to retain his professorship with it. I hardly rejoice at it, except for the cause of science. As a votary of geology, Sedgwick of course must not exchange a fellowship of 430*l.* a year, and a chair of 200*l.*, for a cure of souls of 1,100*l.* It was merely a question of marriage: as a bachelor, he would be mad to exchange a college life, and his position in the University and in science, for becoming a country parson. Some will say that Sedgwick is old enough now to remain a bachelor. He is forty-seven, and from what he told me of his hopes and feelings on the subject of matrimony a year and a half ago, I believe he would be much happier, and would eventually do much more for geology. I warmly remonstrated with Murchison for advising Sedgwick to decline; and on giving my *matrimonial* reasons, got finely quizzed, as you may suppose, and they have been bantering me ever since. As to Sedgwick getting a stall, I hope he will. It should have been

given before, but the Whigs may cease to reign, and he will not cease to grow older—and 1,100*l.* a year is not a bad thing to have to *give up* to a chancellor in exchange.

I gave Mrs. Mallet an invitation to my introductory lecture, with which she was much pleased, and pressed Mr. Mallet into the service immediately. I wish half my audience may be as intelligent listeners.

Tuesday.—Lord Milton was at Murchison's on Sunday, and it was lucky for Curtis the entomologist, for he was introduced, and Lord Milton also talked to him of his own insect-hunting as a boy, and how he knew the Yorkshire species now, and how fond his sons were of it, whom he would bring to see his collection. Sedgwick asked me to walk home with him. I found a gloom upon him, unusual and marked. I most carefully avoided all allusion to the rejected living, but now when the first excitement of the declining the boon is over, and that others have expressed their wonder at it, and that he finds himself left alone with his glory, he is dejected. He told me, Thursday last, that he wished before he left Cambridge to *do something*. 'Now if I take a living instead of going to Wales, I abandon my professorship, and cannot get out the volume on the primary rocks with Conybeare,' &c. Then he hinted that in a year, when this is done, he may retire on some living, and *marry*. But I know Sedgwick well enough to feel sure that the work won't be done in a year, nor perhaps in two; and then a living, &c., won't be just ready, and he is growing older. He has not the application necessary to make his splendid abilities tell in a work. Besides every one leads him astray. A man should have some severity of character, and be able to refuse invitations, &c. The fact is, that to become great in science, a man must be nearly as devoted as a lawyer, and must have more than mere talent.

As I was much amused with Power, in an Irish character, on the night I heard Miss Kemble, I went again to the Adelphi to hear Yates for a couple of hours, which is as long as I like to be at a play, and got home and in bed by eleven o'clock. I have enjoyed parties, and two plays this last month very much, because it was recreation stolen from

work; but the difficulty in the country is, that on the contrary, one's hours of work are stolen from dissipation.

Wrote to your father on geological queries of Dr. Fitton —frank from D. Gilbert. His brother-in-law, Guillemard, came to ask me to come down a fortnight hence into the country with him. I refused with pain, but it is only by resolution of this kind that anything can be done. I always reflect that if I had a recognised profession, all the world would think me right, as called upon to be equally unfriendly; therefore, as I am determined to make science a profession, I will do it. In the end they will think me right.

Another day nearly gone and not through chapter i., so short a one too! But in it I am grappling not with the ordinary arm of flesh, but with principalities and powers, with Sedgwick, Whewell, and others, for my rules of philosophising, as contra-distinguished from them, and I must put on all my armour.

I found on my return three small volumes from Basil Hall—voyages, travels, second series; most diverting—not yet out, though reviewed three weeks! Stokes remarked to me that his enthusiasm about my first volume, and the manner in which he went about, when I was in the Pyrenees, crying it up as the finest thing ever written, was anything but that of an egotist entirely absorbed in his own literary works. He read it at the Athenæum till some one told him he kept it too long, and then he bought it, and they say thought and talked of nothing else but my geology for a month. I had met him at a relation's four years before in Angus, but was never intimate till my return from France. The first thing he said to me on my return was, 'Lyell, I never thought you had it in you to write such a book. I don't mean as a geologist, but as a writer. That passage about Vesta and Tivoli might do for the style of any English writer—nothing in Playfair beyond it,' &c. I was more pleased with a compliment as to style from Basil Hall,[2] than I should have been with an eulogy as to general views. In the former he excels, in the latter he is usually wrong; and

[2] Captain Basil Hall, R.N. Author of *Fragments of Voyages and Travels*. See Appendix A.

when he goes East, 'tis a sure indication that the true course is West.

Mantell was at Geological Society, and came home with me—in much better spirits, though overworked. I think he will soon flit to Brighton. He announces that a diploma for me from Philadelphia is soon to arrive.

Mantell is to be here in two hours to spend the evening, a great pleasure, for he is an old geological friend. I went and introduced myself to him on a tour *à cheval*, with a spare shirt or two in my pocket, in one of the Oxford long vacations; and having previously seen the Isle of Wight, ventured to question the whole arrangement of the Sussex beds below the chalk, which Greenough and Buckland, then the top authorities, had given Mantell, who looked up to them as infallible guides. Fitton afterwards confirmed my arrangement and acknowledged it in print, and I got great credit for it with Mantell, who being unable to travel and compare countries, but doing wonders in his small field of observation, was obliged to depend on others for more extensive generalisations. I have watched his gradual professional rise with much interest, and look forward to see him a great Brighton if not London surgeon.

March 31.—I am knocked up a little to day, and half meditate going to Hampstead and taking the Mallets by surprise; for Sundays are Murchison's evenings, and to-morrow Mrs. Somerville is there, and I don't like to go and come away late. I have paid 20*l.* for compounding to Zoological Society, so now I have compounded to all the Societies—a good thing over, instead of being bothered by annual payments.

April 7.—Last night at the Royal Society Sir J. Rennie told me that he and his engineers used my first volume as a text-book, and all I said of currents, &c., he had found true in examining harbours, estuaries, &c., professionally; and he offered to send me a MS. with facts bearing on power of running water, &c. Thus, he said, below old London Bridge the current descending through the arches has hollowed out the bed of the river to the depth of thirty-seven feet at low water (the ordinary depth of the Thames elsewhere is only seven feet), and this for sixty yards below bridge. I have

been so long off the hydrographical part of my book, that this news was very cheering.

Went to Loddige's garden yesterday with Stokes and Broderip, to see 100,000*l.* worth of Camellia Japonica in full blow—a wonderful sight. Belgian affairs hurt their sale. All the naturalists here are much grieved about Holland, as they say the king did so much for natural history, far more than any other sovereign.

April 10.—Yesterday morning I ran out to Kingston Hill, where the farm of the Zoological Society is situated, to try by walking about there to get rid of a slight headache. I took Hall,[3] who wanted much some country air, with me, putting him on the outside of the coach at nine o'clock, while I went in. At ten o'clock we were in the farm of thirty-five acres. Beautiful ground, a view like that from Richmond Hill, down into the rich vale. Saw the Kangaroos, Quaggas, Emus, and other birds and beasts, which are there breeding. After walking an hour, went to the adjoining Combe Wood, classical ground to entomologists, of which I had often read, but never before visited. Saw some insects there, but as the old keeper whom we met in the wood (once himself a collector and dealer) said, 'London is walking out into Combe Wood, and two houses (villas) building in the middle, and all the underwood cut,' &c.

You asked me in one of your letters how I liked Schlegel—so little, that I avoided him. I met him three times, and exchanged some words each time. He is full of conceit, talks incessantly and of everything, not like Humboldt, whose loquacity bored some people, but never me, because unmixed with self-conceit, like Schlegel's. He called at Chelsea and annoyed Mrs. Somerville. He wanted to be pressed, he said, to lecture at the Royal Institution, and wished to know if *he* could be seen from all parts of the theatre, because *the change* of the expression of his countenance would add great effect to his delivery of certain passages; and, 'I will lecture in French, for although I read and speak English *well*, I should be more at home in French.'

April 14.—The old keeper, formerly a regular entomological collector, who I mentioned having met with in Combe

[3] His clerk.

Wood last Sunday, was quite a character. 'When there were but a few gentlemen,' said he, 'who cared for insects, they gave any price for rarities. I remember a red beetle with long horns that sold for two guineas; and once at the bottom of an old stump, just by that copse, sir, I found a quantity of them, and *there was an end of they.*' That is to say, their market value was destroyed. Now that entomologists have multiplied, who really care for things, not because rare, but for the study of them, they scarcely ever buy, but exchange with one another. In another part of the wood we met with two youths who had purchased a regular instrument made for digging for chrysalises at the roots of trees. Think of an invention for that purpose! One of the youngsters said to me, 'What have you seen to-day?' I said, 'Urticæ,' the common tortoiseshell butterfly; to which he replied, 'I have seen Gonepteryx rhamni,' the yellow brimstone papilio. I was rather pleased with this adventure, because it was a cold ungenial day, and it required all this to make me believe that it was really the Combe Wood that I had read of as a boy. We found some black beetles, and I found that Hall remembered the exact names—it is wonderful how fond he is of entomology. I should never make him take to geology in the same way. He has planned himself a nice wire net-hoop, which goes into his hat, and takes out and fits into a walking-stick. To-day Lt. Graves dined with Broderip, and I joined them at dinner, sending, in old college fashion, wine down to Broderip's rooms. He is a thorough good sailor, and a naturalist; sent by the Admiralty to survey Loch Neagh in Ireland, and going out to the Grecian Archipelago.

It was curious enough that I should have met Spedding just as I was turning into King's College Chapel, because about two months ago we were saying what a complete failure that same chapel was of Smirke's, not being even so much like a place of religious worship as most conventicles. Spedding and I had been accustomed to those two beautiful chapels, Lincoln's Inn and the Temple, where the service is admirably performed 'in all the beauty of holiness,' as David would have said, and the preachers excellent—Lloyd, Heber, Maltby, and many other eminent men being the

preachers there, since I remember. I think there is much in the association of the building, and our chapels at Oxford are so beautiful.

April 21.—I cannot imagine anything more afflicting than such a death as poor Mrs. W.'s,[4] and believe that in such a case the only state of mind in which a person of real feeling can find the least comfort is that of religious resignation. It matters comparatively little, as far as that consolation is concerned, how many erroneous dogmas and absurd rites are connected with the religion, provided its professors do not see through their fallacy. All I wonder at is, that enlightened and inquiring minds can, even by aid of early association, reconcile themselves sufficiently to some parts of the Catholic creed and ceremonies. If it were not, however, for the proneness of the people to superstition, and their gullibility, I should like a good deal of ceremonial. I like our English service so much better than the Scotch. I know some religious Frenchmen, who say they would turn Protestants if *we* did not believe so much the same as Catholics, and that our creed is not much more philosophical than theirs. I almost wonder how some of your German friends can be such staunch Catholics and so tolerant. I have sometimes thought that if all the world should become Christian, and be as divided into sects as we now are, and as tolerant as the Prussians, we should come round once more to the opinion of the Romans, who most sincerely believed 'that all religions were true'—that the gods or saints of all and every people were *their* gods, and that their forms of worship were true, and worthy of veneration, though some more and some less. That they were all, in short, modes of adoring Him whom, as St. Paul says, 'we ignorantly worship.' Talking of sects, a curious thing has happened here. The Society of Useful Knowledge started a penny magazine a month ago, admirably done and very entertaining, and with a good moral tone. They sell 80,000 copies—an unexampled success—well illustrated and remarkably cheap. The Dissenters have been so cut out in the sale of their innumerable tracts, that they preached against the magazine, and thus doubled its sale. The Church party could not help liking

[4] The wife of a Professor at Bonn.

what the Dissenters disliked, and so they rather patronise the concern.

Wednesday.—A letter from Kinnordy from your father, and was much delighted to find he was at last *domiciled* there. He begs hard of me to sit for a portrait to Richmond. When Mrs. Horner first asked it, I spoke to Wright, who did those likenesses so well for Phillips, R.A., but I was so pressed for time, I gave it up. If I do it, I shall go to Wright, at your mother's old request. A north-country attorney called this morning with a brief. He expressed great admiration of my work on geology, and said it was thought much of in the north. I declined the brief, though he tried to persuade me that as it was merely an opinion wanted on a simple road question, I might without scruple pocket the fee. Of course I might have got a friend to do it, but I have cut my cables, and now I will stand firm by one business, and one only. If nothing untoward happens, you will see I shall turn it yet to profit as well as fame.

April 24.- A letter from Elizabeth. Very sorry Mr. Horner was gone, very dull without him. He was a great favourite.

May 1.—I am just returned from Hampstead. Have walked home with Herman Merivale, whom I like as a well-informed man, and particularly in a *tête-à-tête*. He is, I think, very remarkable for his age, in the accuracy and extent of his acquirements. I like him, too, especially as a brother Oxonian, for the warmth of his advocacy of the more general cultivation of all branches of science, especially against the Oxford exclusive system.

Wednesday.—Grand disputes at the Geological Society about the propriety of admitting ladies to my lectures. Babbage most anxious to bring his mother and daughter and Lady Guildford; Harris to bring Lady Mary Kerr; and so on. I begged them all not to do so, and they promised; but at last Murchison said, 'My wife, however, must come. I promised to bring her, and she would be much disappointed. I will not bring her till the doors are closed.' Then they all declared they would too, and so bring the affair to a crisis one way or other.

Friday.—Prepared yesterday a new lecture. The ladies,

Dr. Fitton, and others have been assailing Dr. D'Oyly and others of the King's College Council to admit ladies, and they seemed disposed. At all events I am likely to have a large audience to-day. Only nineteen subscribers up to yesterday, but I met with Spedding, who said, 'I am going to subscribe. Ignorant as I am, I followed you so well that you have really *forced* me, at great inconvenience to my law studies, to attend.' His and many other names are not down yet.

Tuesday.—I have most completely succeeded in my second lecture, which was liked much more than the first. I tell you these things freely, because you know it is not from vanity, and only between ourselves. I worked hard upon the subject of the connection of geology and natural theology, and pointed out that the system which does not find traces of a beginning, like the physical astronomer, whose finest telescope only discovers myriads of other worlds, is the most sublime; and as there is no termination to the view as regards space of the acts of creation, and manifestations of divine power, so also in regard to time, &c.; concluding with a truly noble and eloquent passage from the Bishop of London's inaugural discourse at King's College, in which he says that truth must always add to our admiration of the works of the Creator, that one need never fear the result of free inquiry, &c. I did not the least, in the opinion of Fitton and Babbage, compromise the utmost freedom of the philosopher; while Lonsdale, the Archbishop's secretary, Archdeacon Cambridge, Otter, and others were most exceedingly pleased. Mrs. Somerville and Mrs. Murchison were there. The professors mustered very strong in honour of me to-day, and the number of gowns, to an *old Oxonian*, looked most respectable and dignified. You don't know how, from old association, we attach respect, order, academical rank, &c., to these insignia. For my part, though I don't care about them at King's College, I cannot believe that I should look back to Oxford with as much regard but for these dresses. They become so interwoven with all our ideas of college, as much as a military costume to an officer. I slept ill last night, but no coming lecture will ever discompose me again. Jelf the clergyman, and his brother the lawyer and others,

pressed me to publish the lecture. D'Oyly thanked me for the benefit I had conferred on King's College, &c.

May 7, 1832.—Went up to Hampstead, did not find Mrs. Mallet, but wrote her a note, offering her free entrance to my lecture-room, with two other ladies. Dined at Chelsea, and asked Mrs. Somerville to come to my lectures, and her two daughters. She said she was charmed with the effect my first lecture produced on Martha and Mary. They never would read before, but when they came home they set to work in earnest at my two volumes, and examined each other on the points of the lecture. The Somervilles are to come *regularly*. Then to Murchison's *soirée*—very full. Many had objected, or rather *some*, to the last part of my lecture, as too free; but Babbage and others had converted almost all to think with them of the good I had done, &c. Walked home with Stokes, rather late.

I begin to flatter myself that I am, as Lubbock said last night, when he came down from the R.S. chair, doing good to science by these lectures, which at all events are talked of over London, but politics are of course the chief and absorbing subject. I am going to Uncle Lloyd's to dine, so if I do anything to-day to the book, it must be between this and dinner; so let me not play the dog in the fable, and lose the substance by catching at the shadow—the solid reputation in many countries which my work may earn, for the exciting ready-money profit and applause of a lecture-room.

A letter just arrived from J. Murray, jumping at my proposed reprint, and only doubting between 750 and 1,000 copies for next fourteen months. Bravo! Lord Tyrconnel has been begging me to give a *glossary* of such words as *tertiary*, and says it will sell hundreds more. I suspect it will, but fear delay. I shall set Martha and Mary[5] to make a list of hard words. I am in for thirteen lectures in consequence of repeating the first: if I can cram in three in one week I will do so.

Last night, in the House of Commons, Sir Robert Inglis declared that if the Duke of Wellington, now Premier, and trying to form an administration, takes up the Reform Bill as reported, all character and morality in public men will

[5] The Miss Somervilles.

for ever be destroyed. Baring said no administration could be formed but by reform. In short it seems impossible for the Duke to make an effective cabinet, and not impossible that Lord Grey may be recalled. Of course with the Tories so divided, and a majority of eighty in the House of Commons for reform, great concessions must be made. Sedgwick being at my lecture, I took a shot at him, which amused Fitton, and made him come up laughing after lecture, and shake me by the hand. Murchison said to-day, 'I don't know when they will leave off saying the last is the best lecture of all.' Every one can hear every word, even most distant benches. Sotheby came to-day, Malthus Junior, the Dean of Carlisle, only Dr. and Misses Somerville: she came not, being rather unwell. Such inquiries for her by strangers, as since her work was reviewed in the Edinburgh (for Herschel's in Q. R. is not yet out) she has been the great lion in town. How strange that people never knew before that she could have done all this ten years sooner! They knew it in France. I have told Murchison I cannot be President. He remonstrated, and was sorry, but I was firm, and I suspect he thinks me right. It is just one of those temptations the resisting of which decides whether a man shall really rise high or not in science. For two more years I am free from *les affaires administratives*, which, said old Brochart in his late letter to me, have prevented *me* from studying geology *d'une manière suivie*, whereby *you* have carried it already so far.' The Duke of Wellington has been unable to make a ministry: so much the better, so Lord Grey and the rest are back again.

Your father will tell you what an actor-like sort of celebrity my lectures obtain me, but I will look to something more solid. I am not improving my work and my own mind by them so much as by tranquil uninterrupted study. As I have renounced being President of the Geological Society, so will I write to Otter that I do not pledge myself to give any lectures next year, waiting till the second edition of my *whole* work is ready for press, and I will give him all my reasons—being all connected with my pursuing my original researches without disturbance, until this work is accomplished, and got out in its permanent form. Murray says it must be printed in a cheap form, which I am glad to hear.

Fitton said, 'I'm so sorry I missed you last time, when the world says you floored Buckland.' As Babbage expressed it in a note, 'tore Buckland's theory to tatters before his face.' But I must say B. showed his good sense, for he has been more good-humoured since. But he and Sedgwick & Co. blaze away at me so, I can but retaliate. I pronounced my *éloge* on Cuvier to-day, and a digression on the comparative state of advancement of natural history in France and England, and quoted Herschel and Babbage on the decline of science, &c. The episode was, I fear, rather too long in proportion to the geological part of the lecture, but I am rather glad to have unburdened myself.

May 27.—You cannot think how Marianne and Caroline were charmed with Mrs. Mallet for her frank manners, and the soul with which she entered into everything. Babbage wrote me a note about my last lecture which I was glad of. I doubted whether my *éloge* of Cuvier, and my comparison of French and English systems of cultivating science, had been popular. It seems they were, especially the former, and the latter cried up by Babbage & Co. with enthusiasm.

One can only please one party in some things. He wants me to print it, but I shall not be drawn into controversies of the kind. Babbage in his note, enumerating distinguished German *savans* to whom we cannot show any equals in their respective branches, reckons up many names of astronomers and others, whom I never heard of, and at last one, who he says has just married and become rich, and all agree is doing and likely to do *nothing*. We have at least no danger on one score, that of being *rich*, which I am sure, much as money is wanted in science, does stop men's careers more than anything, and gives them innumerable duties, by which they become stewards of their property, rather than men who have time to devote to philosophical pursuits. By withholding the temptation of the President's chair and the lectures at K. C. next year, I shall, I think, have done two virtuous acts of self-denial, but they will require to be backed by still greater; for precisely in proportion to my not having any of those public and ostensible engagements to plead, will be the difficulty of fighting off the importunities to idleness with which I shall be assailed. Did I tell

you to what a fit of desperation the interruptions of genial Oxford have at last driven Buckland? Literally obliged to hire another house out of town, five miles, and to leave his library and other conveniences! Had he not got the 1,000*l.* we should never have had another volume from him; but, luckily for his fame, it became at last his duty, and he was driven to the plunge. The loss of time in travelling to his library, and going for books of reference, will be immense. I think I should have given out that I was dying, and fee'd a physician to have given bulletins. But then one's relations would not have kept the secret. I reckon that the loss of time, of reference even now and then to one book, as far off as G.S. from me, is so great, that it is cheaper in general to buy. Only think of his going five miles from his books!

Otter said to me, 'You will find that when you are married you will do a great deal more in geology than as a single man, particularly as you will be able to follow it up most successfully as a profession.'

CHAPTER XVI.

JUNE 1832—APRIL 1834.

HIS MARRIAGE—TOUR TO SWITZERLAND AND THE ITALIAN LAKES—RETURN TO LONDON—LECTURES AT THE ROYAL INSTITUTION—HEIDELBERG—VON LEONHARD'S LECTURE—DR. SCHMERLING'S WORK IN THE CAVES NEAR LIEGE—DR. BOWSTEAD—SYDNEY SMITH—THE DRUMMOND LIGHT.

CORRESPONDENCE.

To CHARLES BABBAGE, ESQ.

2 Raymond Buildings, Gray's Inn: June 3, 1832.

MY dear Babbage,—I proposed to Fitton to take up the lectures on geology, as my friend and representative at King's College next year, while I am completing my education and work; and in a kind spirit he has at first sight of it agreed. He could begin with Maestricht beds just where I end, and I really know no one whom I would allow of all the London geologists to teach in my place so soon as Fitton, as he enters so fully into the spirit of the 'modern cause' system.

Otter is delighted with the idea, having paid me the compliment of being quite down in the mouth at my not lecturing next year. Fitton will consult you, so take care you are not the cause inadvertently of his gibbing. You know how many years we have been in getting him to let out his knowledge, and this would be a most effective vent, and we should all profit. To me, of course, it would be falling on my legs most agreeably.

You will be glad to hear there are symptoms of repentance in regard to the hasty resolution of the council at K. C. against the admission of 'women.' I have said nothing in remonstrance, but they have made the discovery.

I have worked in the Temple of Serapis, and will soon send back the books, &c. The *Balanus* is *B. sulcatus*; the *Arca* I have not yet got at.

Ever truly yours,
CHARLES LYELL.

To G. MANTELL, ESQ.

June 14, 1832.

My dear Mantell,—My lectures were splendidly attended. I have shown the public, and made the discovery myself, that I *can* do the thing, and it may yet provide travelling money. But I shall not give much time to it, at least for several years. When the course was over, I received from some of the class whom I never saw, most enthusiastic letters, expressive of their admiration and gratitude. This is worth much—especially as they had the good taste not to applaud in the theatre.

Buckland was really powerful last night on the Megatherium—a lecture of an hour before a crowded audience: only standing room for a third. Lots of anatomists there; paper by Clift; the gigantic bones exhibited, and still to be seen there, but likely to be removed by-and-by. Buckland made out that the beast lived on the ground by scratching for *yams* and *potatoes*, and was covered like an armadillo by a great coat of mail, to keep the dirt from getting into his skin, as he threw it up. As he was as big as an elephant, the notion of some that he burrowed under ground must be abandoned. 'We may absolve him from the imputation of having been a borough-monger; indeed, from what I before said, you will have concluded that he was rather a *radical*.' He concluded with pointing out that as the structure of the sloth was beautifully fitted for the purpose for which he was intended, so was the megatherium for his habits. 'Buffon therefore, and Cuvier even, in describing the sloth as awkward, and Cuvier the megatherium, erred. They are as admirably formed as the gazelle,' &c. It was the best thing I ever heard Bucklan do.

Most truly yours,
CHARLES LYELL.

To His Sister.

Bonn: July 3, 1832.

My dear Maria,—The grand day[1] is at last fixed for the 12th inst. Professor Sack, the Protestant clergyman (or Lutheran, as they say here), agreed to put off his lecture in order to oblige us. He appears to be a very superior man; indeed, I should think, from what I have seen, that the different departments were generally very well represented in the university here, and the Government seems very liberal. They tell me the king gives 14,000*l.* sterling a-year for the Botanic Garden. The Professors have to lecture nine months in the year—too much, I should think, for allowing time for due advancement of the teacher. On Monday we had a grand expedition to Godesberg. All we *ten*, Miss Parker included, Mrs. Barton (widow of a General Barton), her daughter, Mr. Frederick Windischmann, a gentlemanlike young son of a Bonn Geheimrath, and Count Schlabrendorf, eldest son of a rich Silesian noble, a young student. Godesberg is looking most delightful now, and the scenery, both the home views and the distant, are scarcely equalled by those of any single spot I know.

I have exchanged calls with Schlegel, and as I hear he is reading Rossetti in earnest, and much interested in it, I hope he will give my father the benefit of some of his own comments upon it.

Your affectionate brother,

Charles Lyell.

To His Sister.

Axhern (near Strasburg): July 20, 1832.

My dear Eleanor,—I hope to send this letter from Strasburg to-morrow, and shall first take up the diary from Heidelberg, which we stayed at on the 18th. Leonhard was very attentive, showed me part of his collection, and begged his wife to take *mine* to a fine view from a neighbouring hill; then went with us to the castle, showing me by the way some geological sections, which, added to my short excursion

[1] His marriage with Miss Horner.

to the Felsenmeer, have enabled me to obtain something like a fair notion of the Odenwald, both its scenery and geology. I then introduced Mary to Bronn, Professor of Natural History, and learnt some geology from him of the country in a different department from Leonhard's. Next day, the 19th, to Carlsruhe, making a delightful *détour* on the road, up a small valley leading from the plain up into the Odenwald hills, where I went to see a singular deposit, called 'loess' provincially, filled with recent species of land shells, and which is peculiar to the Rhine valley, found at Bonn, Strasburg, and hundreds of intermediate places. The Bergstrasse, I should tell you, is a line of road running nearly north and south along the foot, first of the Odenwald, as from Darmstadt to past Heidelberg, then of the Schwartzwald, another chain of mountains, which we have seen all to-day in coming from Carlsruhe to this. The plain of the Rhine is nearly as flat as that of the Po, and like it composed of horizontal beds of gravel and sand, hundreds of feet deep at least, but depth unknown. The mountains are of inclined strata of older rocks. If you keep in the plain it is like sailing on the sea and having a distant view of an adjoining isle, or mainland; and Mary was not sorry that my geological tastes have led me several times to *land*, and make short trips into the interior. This morning we saw the palace at Carlsruhe, and then returned to the Bergstrasse, making an excursion up the valley of the Murg, and from that to Baden-Baden, the pleasantest German watering-place I have seen.

With love to all, your affectionate brother,

CHARLES LYELL.

To HIS MOTHER.

Strasburg: July 22, 1832.

My dear Mother,—Voltz, a mining engineer of this place, and a good geologist, gave us a famous view of the Museum here on our arrival yesterday; after which I went with Mary up the tower of the Cathedral, and saw a fine panorama of the great plain of the Rhine, with the Schwarzwald on one side and the Vosges on the other, rising rapidly from the

plain. On the north the plain is uninterrupted, but looking south you see a small group of rocks rising like an island from a sea midway between the Vosges and Black Forest. This group is the Kaiserstuhl, which I am told is an ancient volcano—a submarine one though, and ancient enough. I was thinking of seeing it, but as it would cost a day or two more, I will not go. Voltz has recommended me to go by all means to Berne, as Studer is now there, who is by far the best geologist of Switzerland. As the excursions into the Odenwald and Black Forest have repaid us so well (me in geology, and Mary in seeing the country), I was glad to see a little of the opposite coasts, or the Vosges. Voltz gave me a plan of a trip for to-day to Soulz-aux-bains, or Soulz-bad, which is at the foot of the Vosges, where I saw many quarries of rocks, which compose a great part of the Vosges. It was a delightful drive, first over the plain, then a hilly country, behind which the mountains rose boldly. The costume of the peasants amused Mary exceedingly, and I was delighted by a dance which they had at an inn. The music was excellent, and the waltzing and gallopading by no means to be despised. They seemed so happy and so superior to our peasants in the refinement of these holiday pleasures, that I could not but dwell on the unfavourable contrast. I always fancied that Strasburg was on the Rhine, and marvelled to find that we left the river and found that the city only communicated with it by means of a small canal. The number of the National Guard (6,000), together with several regiments of the line, gave a very gay appearance to the town, and so many soldiers mixed with the costume of the peasants made the roads appear as if there was a national *féte*.

July 24.—From Strasburg, along the Bergstrasse, past the Kaiserstuhl (which became a considerable group as we approached) to Freyburg in Brisgau, a town larger than Bonn, with a University and a most beautiful Cathedral, both in the exterior, which resembles Strasburg a good deal, and the interior, where there is good Gothic architecture and painted glass. From Freyburg we have passed through what the Germans call the 'Hölle Thal,' or valley of hell, a defile in granitic mountains, but which is too beautifully

covered with fir wood to deserve the name. To-morrow we hope to arrive at Schaffhausen.

Believe me, my dearest mother, your affectionate son,

CHARLES LYELL.

To HIS SISTER.

Sumiswald: July 28, 1832.

My dear Fanny,—We are here, on our way to Thun and Interlachen, at a small inn. This route, which we take as the easiest, and not requiring pedestrian or equestrian exertions, like the Brunig, has shown us so much quiet liveable home scenery, and cultivated gently undulating ground, as I really hardly knew to exist in Switzerland, where one usually keeps so close to the mountains. We see many new houses of the best style built in every part of Switzerland, which bespeaks the growing prosperity of the country, and which is never seen in Rhenish Prussia. The part of the Bernese territory which we have been in, looks particularly flourishing.

Berne: July 30.—I was much disappointed at finding Studer absent, and mean to go with Mary in search of him to-morrow at Gurnigel, five leagues distant. At Thun we saw the Jungfrau in great beauty, and though the view of the Alps from the ramparts here was not so clear as that we saw in 1818, it was nevertheless very fine, and only half covered with white clouds mingling with the snows. They have now four bears in the moat here, and a herd of deer. The town and everything in the canton looks most flourishing. As my rapid tour has served to excite, rather than satisfy my curiosity about the geology of Switzerland, I want to ask Studer a hundred queries. He is just about to publish on the geology of the country, and ought to stand a good examination.

Fribourg: August 1.—We are stopping here for a twelve o'clock dinner, having breakfasted at six o'clock. The view of the Alps as we left Berne was very fine. Yesterday was a well-spent day. We started early for Gurnigel, the highest watering-place in Switzerland, among the fir woods. Found Studer, a good, honest, intelligent Swiss, not quite read up

to Saturday night, but not so far behind as to be ignorant of a certain work, which made him receive me well, and express himself grateful for my visit. He took me to two ravines, where I saw a considerable section of the flanks of the Alps, very like the Pyrenees. He also gave me useful geological hints for the Simplon, Lago Maggiore, &c. The valley which led to Gurnigel was splendid, and the view of the Alps from it.

Ever your affectionate brother,

CHARLES LYELL.

To HIS FATHER.

Simplon: August 5, 1832.

My dear Father,—We have just reached this village, after ascending from Brieg in a most beautifully clear day, and are sure I think of seeing the descent, which I thought so much more beautiful, in most favourable weather. They say they have not had for a long time so little travelling over the Simplon—absolutely no English. Wars, cholera, and other fevers seem to have put an end to travelling. In the fine parts of Switzerland many French families driven away from Paris by cholera have come and sojourned, which has been some compensation, but none to this noble pass. In spite of this, however, no expense has been spared in keeping up the road here, which is in beautiful order, at least the Swiss side.

Domo d'Ossola, evening.—We reached this by six o'clock. Mary has been amused at the costume of the peasants, at the stone floor of our bedroom, and other novelties to her; among the rest, the announcement that no milk, not a thimbleful, can be purchased in the whole town. And such herds of cows and goats as we passed. So we solaced ourselves with a repast which costs no more, and is perhaps more suited to the climate, an ice and a roll of bread. In my way up the Vallais I just stopped at Bex to call on Charpentier, the geologist of the Pyrenees, now superintendent of the salt mines there. We took a car and drove to his villa. He told me something of the geology of the country, and said if I would return and examine it he should be glad

to show it to me. We find the people here occupied with a *fête 'per l'onore della Vergine:'* soldiers firing, band playing, and a great pole in the market-place, with prizes for the boy who climbs to the top; but they have put up so tall a fir from the mountains, that no one can get a fifth of the way up. But the soap will be rubbed off in time, and by midnight some one will mount. The balconies are full of ladies gaily dressed, and the crowd laughs loudly as often as any one slips down the pole. They call this *la cocagna.* At Vevey, I wrote to my geological friend Necker, to announce our intended visit to Geneva and Chamouni.

Milan: August 7.—We saw the Boromean Isles in great beauty, and had the gardener, who was so fair a botanist, to show us the trees and shrubs. I am grieved to hear that Boromeo's eldest son (aged about forty), a geologist to whom I had letters last time I was here, and who *in spite* of his rank is really advanced in scientific knowledge, is gone to Aix in Savoy. At Arona, yesterday, we went up to San Carlo Boromeo's statue, really a fine thing, and interesting also from the great deception, produced I suppose by its good proportion; for when you are at the foot of the statue you would not believe that your arm could go into the nose, whereas half your body, with head and arms, may be packed into it. You mount by a long ladder to half the height, then by an iron bar within, not a thing for *ladies,* nor indeed for gentlemen who have not good nerves. I went up, and got into the *nose,* at least part of me. Mary was glad when I was down again, though really there is no danger, and, on the other hand, no recompense for the trouble and fine of four francs. After we had boated it most agreeably to the isles, and got off in the carriage, a storm, the first rain for two entire months, came down and laid the dust. It has much refreshed the country. The Lago Maggiore is nearly of the same colour (cabbage-green if I may be so unpoetical) as the lakes of Switzerland which send their waters to the Rhine. Geneva Lake is a deep blue, and, if I remember, much more like the Mediterranean, to which its waters flow. Now that they have made out that the sea contains iodine, as do many mineral springs, and that there are innumerable mineral

springs in the Alps, I suppose they will find a solution of their colour, but I forget Davy's conjectures on the subject. With love to all,

Believe me your affectionate son,

CHARLES LYELL.

To CHARLES BABBAGE, ESQ.

16 Hart Street, Bloomsbury: Saturday, January 5, 1833.

My dear Babbage.—This year I am determined to give the Temple of Serapis in grand style, and am preparing scenic illustrations.

Would you be so kind as to lend me again all the plates on that region which you let me have last year, and which I was unable then to make use of.

The Royal Institution, hearing that the King's College will not admit *ladies*, have sent me an invitation of a pressing kind to give them some six or eight lectures after Easter, offering me what I believe they consider very favourable terms as far as emolument. I am inclined to accept, but must think of it. I shall have time certainly.

If not at home when the bearer leaves this, you can look out the plates and leave them out for me, and I will send again. I should like to show you Sir W. Hamilton's plate of the place where I think you found the serpulæ on the cliff south of Puzzuoli, to ask you if am right.

Stokes and Broderip are to dine here on Tuesday at six o'clock, no one else. Could you not join the party, and renew your acquaintance with my wife? I cannot tell you how much pleasure it would give us, to see you here at our *first* party. Ever yours most truly,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

London: April 30, 1833.

My dear Mantell,—Like all the world, I have had the influenza, which went through my house, servants, visitor and all, save Mrs. Lyell, who remained well to nurse us. This *embarras*, and getting *out* vol. iii. and *up* two courses of lectures, must be my excuse for not having written to you or

anyone. My introductory lecture at the Royal Institution last Thursday was attended by 250 persons. This morning, the first King's College lecture by 200 persons, or, as some compute, 250. Nevertheless, I doubt whether I shall have any class, scarce any having as yet entered; and Jones, the Professor of Political Economy, a very eloquent man, having had an audience of 200 the first day, had on the third not *one individual*, and now he goes on lecturing to five, which I would not. I was very happy to have my 200 to preach the true doctrine to, gratis.

I am glad you have got your book out so soon. I mean this summer to geologise in the Tyrolean Alps, and make up my mind on Von Buch's dolomisation theory.

I start June 9, with Mrs. Lyell.

I have been taking lessons with her on shells from G. Sowerby, who is a bankrupt, and now wishes to be a teacher in Natural History, for which he is better qualified than for shop speculations.

Believe me, ever most sincerely yours,

CHARLES LYELL.

To DR. FLEMING.

16 Hart Street, Bloomsbury, London: May 1, 1833.

My dear Dr. Fleming,—I am at a loss to decide how to send you a copy of my third volume, which has been out this week. I think you told me you should soon establish some regular mode of communicating between London and Edinburgh, and that you would let me know how to forward a parcel. I long to hear whether you have made progress in the Fife coalfield, especially in the fossil shells and plants, and *vertebrated* animals of the period, when only 'the simplest forms of organic life' were in existence. As Agassiz the icthyologist was seized with a complaint in his eyes, and his visit to England consequently deferred, I have made no step towards settling the genus and species of my red sandstone fish, which I much regret.

Since I launched my work, I have been busy lecturing. The King's College governors determined this year that ladies should not enter my lecture-room, because it diverted

the attention of the young students, of whom I had *two* in number from the college last year, and *two* this. My class being thus cut down to fifteen, I gave them a short course, which is now going on, and I find them very attentive and in earnest, but I would not of course give the time to such a class again. The Royal Institution invited me very warmly to lecture in their theatre, and I consented to seven lectures, which have been attended by 250 persons (scarce ever less), about a hundred of them *men*. But I do not fancy this want of concentration of my lecturing labours, and shall either settle upon some one theatre, or stick to writing, which I believe is most improving and profitable in every way. I regret that the bishops cut short my career at King's College, as I should have had a splendid class this year, and thrice as profitable as at the Royal Institution, but there seems no way of having a large audience but by one of two methods—an academical class, or one open to women as well as men. Grant lectured *gratis* at the Zoological Society to overflowing rooms, but the moment he began at the London University, for a trifling fee, only about eight or ten students came. Yet people will still buy dearish books, and though willing to hear Turner lecture gratis on Chemistry or Geology, they will not *pay* at the rate of 1*s*. a lecture to hear him. My book has got on so rapidly, as to put me in great good humour with the public. Bakewell has just come out with a new edition, but I have not heard whether there is anything new in it. I get on in conchology somewhat, and Mrs. Lyell and my sisters, two of whom are now with me, make rapid progress. I am going this year to the Tyrol, to make up my mind about Von Buch's theory of dolomisation of the limestone of the Alps. Ever most truly yours,

CHARLES LYELL.

To HIS SISTER.

Paris: June 18, 1833.

My dear Marianne,—We are just returned from a visit to Montmartre, where I have shown Mary the underground streets or excavations made to extract gypsum—the same gypsum in which Cuvier's celebrated animals were found.

She had also an opportunity of collecting a fossil shell or two for the first time. The view of Paris from Montmartre is by far the finest there is; St. Denis seems very near you on one side. I was much amused at the Geological Society last night. My last volume has told here very much. Prévost assures me that the first two were far beyond them here. He says they are beginning to appreciate them, but that it will require several years before they see as clearly as he does the geological bearing of them. There have been several schemes to translate the work, but the German translation checks them; for they say that in France every one writes, and no one reads or buys, and that they depend regularly on Germany and England for the sale of two-thirds of a scientific work. Their sale is far more limited than in Germany. I am resolved to continue with zeal to collect fossils and study conchology. I am very glad to see Mrs. Somerville again, and hear her opinion on society here, which upon the whole is favourable, but not in all things. I know no one further from being prudish, and yet she tells me that she can scarce admit any modern French novel nor literary work into her house, so unfit are they for her daughters.

CHARLES LYELL.

To HIS MOTHER.

Heidelberg: July 30, 1833.

My dear Mother.—I am now for the third time upon the Bergstrasse, and admire it as much as when I first visited it thirteen years ago with my father. When we left Bonn, Dr. Thomson and his son were agreeable companions in the steamboat as far as Coblenz. We first stopped at Neuwied, leaving the boat and taking a carriage at that small village-metropolis, to cross the plain to the boundary hills. We went over an immense flat plain about five miles broad, which is composed of horizontal beds of volcanic matter, chiefly white lapilli of pumice, which we saw at the pits, and when we came to the small river Sayn. Then at the town of the same name we saw the iron-works, having an introduction to the Superintendent. The views of the plain from the hills and the old ruined castle at Sayn are beauti-

ful. We went on to Ehrenbreitstein, slept there, and next morning rejoined the steamer, to be carried on to Bingen, where we disembarked for good, and got a carriage for Mayence and did much geology on the way, in what we call the Mayence tertiary basin. On the 27th July we followed the Rhine to Oppenheim, and then to Alzy, Eppelsheim, and Worms, seeing many quarries, and at Worms much of historical interest, particularly as what I had read in Robertson and Schiller has left a lasting impression. A few miles from Worms is a large lime tree of great age, which stands like a giant, all the other trees in the plain being younger and of moderate height. This tree has been spared because tradition has said that Luther, when he was on his way to the Diet of Worms, sat under its shade to rest. It is called 'Luther's Linden.' Worms is a fine old place, standing in a great plain. We looked down upon it, and in the distance on the one side, the Hardt mountains and the Donnersberg, which we had approached in our excursion the day before, and on the other, the hills at the foot of which we now are. Opposite the cathedral, on the very spot where the Rathhaus stood, while the Diet was held, stands the Lutheran church, in which the Lutherans and Calvinists now join worship in the same service here (Darmstadt), as in Prussia. The church is very simple and plain in its exterior, but within is remarkably striking. It is not much more than a century old. On the entrance side is a large picture of the Diet of Worms, Charles V. in the chair, and on his right cardinals and bishops; on his left, nobles in their robes; before him, Luther standing and speaking against Eckius, who is contending on the other side. There is a gallery on one side only of the church, all along the front of which is a double row of pictures, more than a hundred I should think, painted I believe on wood, the upper row in illustration of the Old, the lower of the New, Testament. Each tells its tale admirably, and the effect of the whole as adorning the church, the ceiling of which is coloured so as to harmonise, is quite beautiful. The pictures are very amusing, and many of the marvellous stories of the Jewish history are collected; and from the Revelations there are dragons with many heads and other beasts, and Death on the pale horse, &c. I should

suppose that the children, and not a few grown-up folk, are employed during service in divining what the pictures relate to. Martin Luther himself would stand no chance with the artist. For what he said on this spot I believe he was imprisoned: it is curious that his church should now stand there, exactly opposite the old vast Catholic cathedral.

July 31.—After passing along the plain from Worms to Manheim, we crossed the Rhine on entering the latter, and climbed the tower of the observatory, where we had a splendid view. In the town, the juncture of the Neckar with the Rhine; in the distance, Spires on one side, Worms on the other; the Vosges and Black Forest mountains to the south, and the Taunus to the north. Professors Von Leonhard and Bronn have been very attentive here. Yesterday evening we spent with the former, and this evening with the latter. After the party at Leonhard's, Mary and I took a moonlight walk over the ruins of the old castle, and stood on the splendid terrace which overhangs the Neckar. I received a letter from Count Münster of Bayreuth here, in answer to one from me from Bonn, saying he will be glad to see me, and will be at home, and pointing out things which he recommends me to see before reaching him. He has not only the first collection in Germany of fossil remains, but is reputed to know more about them than any one else. We go by Heilbronn, Stuttgardt, Göppingen, Pappenheim, Solenhofen, Nüremberg, Bayreuth (seeing the famous caves of Muggendorf, &c., between the last places), Bamberg, Würtzburg, Aschaffenberg, Frankfurt, Bonn.

With my love to all at Kinnordy, believe me, my dearest mother, your affectionate son,

CHARLES LYELL.

To HIS FATHER.

Manheim, near Pappenheim, Bavaria: August 8, 1833.

My dear Father,—We have just reached this on our way to the famous lithographic stone quarries at Solenhofen. My last letter to my mother was just before quitting Heidelberg. I attended a lecture of Von Leonhard on mineralogy, and was much interested. He has been the first to introduce

a modified Lancastrian system of instruction into his lectures. When he has given a general history of a particular mineral, he describes a certain number of specimens to four or five of the more advanced of his class, who have already followed one or two courses. He then passes to one end of the room, and a small group closes round him, each seeing the specimen well. He goes on: '*Epidote*, this pale green is epidote, the white is quartz,' &c. The others go round the room with their specimens at the same time, so the whole class is for some time broken up into a number of private lecture pupils, till the exhibition or 'demonstration' is over, when the whole are again intent on the general views of the Professor, who holds forth in a pleasant, easy, extempore strain. He only got through two minerals in the hour. At Stuttgardt I got a hasty view of two collections and of Drs. Hähl and Jäger, the latter an author on fossil remains. I was lucky enough to meet Professor Voltz, of Strasbourg, at Dr. Hähl's, who gave much information on the fossils.

We saw Danneker's studio, and the sculpture by him in the palace. I do not admire D.'s Ariadne, which is so much talked of. His Christ I thought very fine, and many others beautiful. I went to Göppingen, at the suggestion of Count Münster. Dr. Hartmann, physician at Göppingen, has a magnificent collection of organic remains of secondary rocks, and was very liberal in giving me specimens, and took us to some localities where we collected plentifully.

Believe me, your affectionate son,

CHARLES LYELL.

To G. MANTELL, ESQ.

16 Hart Street, London: September 16, 1833.

My dear Mantell,—I have just arrived from Dover, having passed through Belgium in my way. I saw there at Liege the collection of Dr. Schmerling, who in *three years* has, by his own exertions and the incessant labour of a clever amateur servant, cleared out some twenty caves untouched by any previous searcher, and has filled a truly splendid museum. He numbers already thrice the number of fossil cavern mammalia known when Buckland wrote his 'Idola specûs;' and such is the prodigious number of the individuals

of some species, the bears, for example, of which he has five species, one large, one new, that several entire skeletons will be constructed. Oh, that the Lewes chalk had been cavernous! And he has these and a number of yet unexplored, and shortly to be investigated holes, all to himself. But envy him not—you can imagine what he feels at being far from a metropolis which can afford him sympathy; and having not one congenial soul at Liege, and none who take any interest in his discoveries save the priests—and what kind *they* take you may guess more especially as he has found human remains in breccia, embedded with the extinct species, under circumstances far more difficult to get over than any I have previously heard of. The *three* coats or layers of stalagmite cited by me at Choquier are true. Talking of the priests, they have obtained grants for new monkish establishments in Liege, while the University of Ghent falls to the ground, and the Protestant professors are cashiered, and King William's patronage of natural history excluded. The movement was mainly one of Catholic bigots against a king who wished to introduce schools, and who, whatever faults he committed, was of all European sovereigns the greatest promoter and most judicious patron of physical science. Leopold has nothing left for it but to lean on the priests, reinforced as they are by the Jesuits exiled from France. But as yet the Belgian press is free: with that there is always hope. I examined near Mons strata of the age of Maestricht, and collected shells of which 250 specimens have been found, and were shown me by Count Duchatel. I saw those newer beds reposing on white chalk with flints, and this on chloritic chalk and chalk marl or malm, very soft and clayey, full of upper G. Sand shells (pecten 5—costatus, &c.). The ancient shore of the chalk, then resting upon inclined mountain limestone, is still seen, as the quarries are worked out, strewed with *pebbles* of coralline limestone (mountain), of old red sandstone, coal shale, &c.; these pebbles covered with green sand species of *plagiostoma*, *patella*, *emarginula*, &c., the softer old-red pebbles bored by fistularia, of which the shells remain —the subjacent limestone seen *in sitû*, perforated by large regular sarcophagous hollows. But better than all, rents and sinuous cavities are seen in the underlying limestone into which the sand of the 'malm' or 'firestone' beds, to speak

Sussex to you, fell, and into which innumerable shells of the cretaceous era were drifted. These shells escaped being stonified, and consequently 200 species the same as in the marl are in a state of perfection rarely equalled by *tertiary* shells. Terebratulæ loose, and with all the internal parts entire. It is a wonderful country, and well ransacked by Duchatel, who took me to the best localities.

Very truly yours, CHARLES LYELL.

[In 1834, he made a tour of several months in Sweden, and wrote a journal to his wife, which was posted at intervals, from which large extracts are given in the following pages. In November of this year he read a paper to the Royal Society on the proofs of a gradual rising of the land in that country, which was published in the 'Philosophical Transactions' the following year, as the Bakerian Lecture.]

CORRESPONDENCE.

To C. BABBAGE, ESQ.

16 Hart Street: January 16, 1834.

Dear Babbage,—I am half afraid you are gone to Cambridge, but will take the chance of this note reaching you, as I am at a stand for want of an answer to what may be a simple question.

Daniell tells me that the melting point of iron, or rather the heat of *melted* iron, is about 4,000° Fahrenheit; and that so long as any fragment of solid iron remains in the melted mass it is impossible to raise the temperature higher—just as water will not be raised above 33° so long as any ice is floating in it. Now he (Daniell) asks whether, if this be the case, the interior of the planet can, as the central-heat men assume, be at temperatures far *above* 4,000° F.? Would this be possible so long as a solid crust above remains unmelted?

I objected that *pressure* might possibly allow of great increment of heat beyond 4,000° without liquefaction being produced. But Daniell doubts whether iron and other solids would be prevented from melting by pressure? At all events, would it not follow that the central parts of the earth, or all below the outer rind, are incandescent and solid rather than fluid? I see that Fourier and other mathematicians assume that it is consistent with the laws which

regulate the progress of heat through conducting bodies that a cold, frozen, solid crust may cover a nucleus which may be at *any imaginable* temperature. Query.

Dr. Young, in his lectures on Natural Philosophy, says that at the earth's centre steel would be compressed into one-fourth its bulk, and stone into one-eighth.

Ever yours most truly, CHARLES LYELL.

P.S.—If you were not a Professor I should have craved a breakfast with you on this subject; but fly me a note, if possible, by post.

To LEONARD HORNER, ESQ.

London: February 26, 1834.

My dear Horner,—Your paper is positively to come on to-night—first my Pyrenees, then you, then Egerton. I stood out for this arrangement, as we had priority by right. The answering was a heavy business. Greenough not in spirits, Buckland heavy, no Sedgwick. I communicated some information received the same day from Boué about the Strasbourg meeting, and the Stuttgardt reception of the *savans*, which the King of Wurtemburg is preparing. I also took occasion to recommend those who were going to the Continent to visit Germany, and praised their geologists, and stated how interesting the geology of Germany was in relation to our own. Lastly, I gave a rapid sketch of the controversy about the level of the Baltic and rise of Sweden, and announced that I was going there.

Fitton's short speech was the only one which made them laugh. Dublin and Dr. Fitton was the toast. He descended on Antrim, and said that Playfair told him that when he (Playfair) visited the Giant's Causeway 'the sea was rough, a swell, what in Ireland would be called a state of *agitation*. The boatman proud, as all Irishmen are of their country, and annoyed that the stranger gentleman should be disappointed, after two ineffectual attempts to get to the Causeway, said, 'Your honour sees that it's not the sea that is out of humour: the sea (say) would be quiet, your honour, if the wind would but let her alone.' The speakers were Greenough, Buckland, Sir T. Ackland, Sir J. Johnston, Murchison, Fitton, De la Bêche, Lyell, J. Taylor, Dr. Turner. Fitton's account of Greenough's speech was that 'more than

half of it was employed in pelting Lyell with nonsense, and at the end summing up in his favour.'

Yours affectionately, CHARLES LYELL.

To LEONARD HORNER, ESQ.

April 17, 1834.

My dear Horner,—I have been so often in danger of being fairly run down by the printers the last fortnight, that I have found no time to write and congratulate you on the favourable aspect of affairs as connected with the Factory Bill. I begin to be sanguine that the Bill, after considerable modifications when new clauses come into play, will last our time and do good, especially in respect to education, the chief point in which I conceive governments to have a right to interfere, or rather a duty.

I should hope that by returning again and again to the same districts (when you have got the factories in train) you will be able to effect much in geology. For the grand secret is to revisit countries, and to compare them frequently, after thinking over what you see in the interval. If you write on volcanos you can bring in the ancient lava and dikes near Edinburgh, and the volcanic rocks near Dundee. I wrote to Bowstead,[2] to say that if he had any notice on the löess of Andernach, I would read it when I read my paper. After some time he replied that he can venture nothing, but should have answered my letter sooner, had he not been employed this Easter vacation in *geologising* in Derbyshire, with a Mr. Hopkins. Is it not delightful to have got such a man fairly bitten? He concludes his letter with saying he shall see us in June (when we shall be far away), and adds: 'I was delighted to hear of Mr. Horner's appointment to the important and responsible situation which he fills,[3] as I shall ever preserve a grateful recollection of the kindness, encouragement, and assistance which I derived from him in my first feeble attempts at geological investigation. I should long ago have written, had I known Mr. Horner's address in this country, to congratulate him on his appointment.' Amongst numerous sallies of Sydney Smith, some of

[2] Afterwards Bishop of Lichfield.

[3] The Factory Act was passed in August 1853, and Mr. Horner was appointed one of the four Inspectors of Factories that autumn.

which I presume have been told you, when I dined there, he wondered when 'Cockburn would come up to town, and be baptised,' &c. On my saying that he was already one of the most social of beings, a most excellent fellow, &c., Sydney said, 'I know him well, and his merits; but why should a man say I will be intimate and social only when I have known people fifteen years? One must be always beginning, and extending one's acquaintance, or be left alone. Life is not long enough for such a plan. A man must allow for something intermediate between cold reserve and the familiarity of schoolboys. It will not do, sir, depend upon it, for any man to say, "I will shut my mouth, and be reserved to all with whom I cannot play at *leap-frog*."'

You will be glad to hear that Constant Prévost overcame the École des Mines and all the intrigues, and is now *our* French Pres. G. S. I have heard no particulars. Last night I took my brother Hal to see a comparison of the Drummond light and the most intense light of voltaic pile which could be made. The latter they say was most bright, but it was not sustained enough to allow of a fair comparison. Buckland was there, and very full of Hibbert's discovery of a Plesiosaur and *crocodile* in the coal of Edinburgh, or Burdie House quarries. Murchison said that he had not made out that it was below mountain limestone; but I said that, having visited Burdie House, I could not doubt that any saurian found there must have been contemporaneous with the coal plants.

I hope you will be obliged to go to the mills and manse of Clackmannan. I know of no one so able to help one in Scotch geology as Dr. Fleming, especially on the coal. If you are much in Edinburgh, I would determine in five or six years to have the finest collection of the carboniferous beds north of the Tweed. A few pounds annually expended would be justifiable as an *investment*, as Murchison said to me in 1827, after he and others had lost thousands in speculations, and when old Sowerby's family sold his collection well. 'What an ass I was, when I sold my land, not to invest in fossils!' But I know how dangerous it is to begin, unless one confines oneself to a very limited field, either to some one branch of paleontology, or a certain geographical district. Believe me, affectionately yours,

CHARLES LYELL.

CHAPTER XVII.

MAY–JUNE 1834.

DEPARTS FOR DENMARK—LÜBECK—PICKS UP SHELLS ON THE BALTIC—ARRIVES AT COPENHAGEN—EXPEDITION TO MÖEN WITH DR. FORCHHAMMER—THE CROWN PRINCE CHRISTIAN—VISIT TO THE COUNTRY PALACE OF SORGEN-FREY—GEOLOGY—DEPARTS FOR SWEDEN—ENGAGES AN INTERPRETER—LEGEND OF THE BÄCKE-HÄSTEN—CASTLE OF KALMAR.

JOURNAL.

To His Wife.

On board ship for Hamburgh: May 21, 1834.

My dearest Mary,—I have been ten hours without a word with my love, but thinking of her more than half the time, and comforting myself that she is less alone than I am. I foresee much profit from a full conference with the Danes and Swedes. I have learnt much to-day about the state of Heligoland, and will try to get drawings of it. I have been reading Forchhammer, and am quite sure that the geology of the Danish isles, Moën and Seeland in particular, on my way to Copenhagen, will be one of the most important things I have to do. I remember that Deshayes told me that the fossils of Scania were those of Maestricht and Ciply, and from the Cranias and other shells mentioned by Forchhammer, I shall probably find Möen to be so too.

Hamburgh: Sunday, 25.—The scenery on nearing Altona is very beautiful, and sections by the riverside which I sketched, and had decided to see if possible. Landed, and went to Hôtel de Russie. This is a curious old place, more like Nürnberg than any other we saw together, with a likeness to a Dutch town also, with its canals. Drove to Altona, to Prof. Schu-

macher's, who was not at home. Resolved to dash on in a drosky to the section lower down the Elbe than Altona, at about three miles from Hamburgh. Got to the very place I sketched in the morning, at the Teufel's brücke—cliffs, 60 or 70 feet high. Filled three pages of note-book. Saw the source of the great Holstein granite blocks—gathered shells thrown ashore by the Elbe. Returned to Altona and saw Schumacher, Danish Astronomer Royal, a man who has done much to advance practical astronomy as applied to navigation. Went with him to a Mr. Parish, a rich Anglo-Hamburgh merchant, who took me where I wished in his carriage. I have made progress already, I think, in making out the Holstein formation, and by aid of a peasant got two shells which are rare.

Copenhagen: May 28, 1834.—I have not had a moment of leisure to write to you since the morning I left Hamburgh, in a carriage which that kind man Schumacher sent me from Altona, because he said my bones would be broken in a post-carriage, as the road was so bad that twice my head went against the roof or windows. There are two reasons for the disgraceful state of a road which connects two rich and active independent cities, which have their vote. The first is a geological cause, loose sand, and huge boulders floating in it. But why with their wealth do they not break up the granite and macadamise? The reason is that it would half ruin Denmark's king, through whose dominion the road runs. His revenue is principally derived from the dues paid on entering the Sound, and on these the last debt was guaranteed. If the commerce of Hamburgh was conveyed by a good road to Lübeck, half these dues would be lost. So that though Hamburgh and Lübeck offered to make the road, Denmark refused. The negotiation is still going on, and it is hoped Denmark will be shamed into concession. After getting through innumerable small jobs at Hamburgh, and the horrors of packing with an increase of things, small boxes of shells, &c., I at last got off. It blew a hurricane, and the loose sand and the cold forced me to shut up at last, by which I lost no geology. I worked at Rang,[1] and was glad you packed him up, an excellent book. I had collected

[1] Work on Conchology.

shells on the banks of the Elbe, which excited my desire to consult him. On to Oldesloe, about five German miles, having baited one pair of steeds three or four times. Here are salt works, which I saw: then to Segeberg. Here an extraordinary mountain of gypsum, &c., bursts up through the loose sand. I delivered my letter from Schumacher to Geheimrath Von Rosen, who was just returned, late in the evening, with his wife and six young children, from a tour of seven days. Simple mannered Germans. After tea he went with me up the Hill of Gyps, and introduced me to a Norwegian Bergmann, who superintends the works. He was quite my beau ideal of an intelligent, frank, independent Norwegian. It was darkish, so it was arranged that between six and seven next morning I and the Bergmann should examine the hill together, which we did, much to my edification. He was delighted to find I had letters to Count Wedel and other Norwegians. Five hours' ploughing of the deep sands took us to Lübeck. On the way I gathered some freshwater and land shells; read Rang, and Forchammer, and De la Bêche, on chalk, &c.; wished you were in the carriage; and at last got sight of the towers of Lübeck, a very curious old city. I had only three-quarters of an hour before the steamboat started, which conveyed us sixteen miles by water down the Trave, first half fresh, and last salt. By land it was only eight miles, but the steam beats the carriage. The river sometimes opened into a kind of estuary, then contracted—very picturesque. A fleet of thirty fishing-boats were met all together in full sail, going to the Baltic. In two hours and a quarter we were at the small port of Lübeck, Travemünde, where we found two fine steamers, one Russian, just going to Petersburg, the largest; and the other Danish, into which we and our luggage were all transferred.

When my luggage was safe, we had still three-quarters of an hour, and I was ambitious of picking up a shell or two on the borders of the Baltic. I landed, as we were alongside the pier, in our new boat—it was low water. The shore was covered with *Turbo littoreus*, *Mytilus edulis*, *Cardium edule*, *Mactra*, *Tellina*, and quantities of a minute *paludina*, I suppose *P. ulva*. This association of the *paludina* with the marine shells delighted me, as analogous to the Mayence basin, which

was no doubt brackish too. After we had started, I stood washing my new treasures, the shells, in a basin, and packing them up, to the admiration of the crew, who some of them begged the loan of my magnifying-glass. A Russian gentleman, who afterwards proved to be Mr. Eperlim, Russian Consul at Helsingborg, offered, as I seemed to him a naturalist, his services if I wished any information in my travels in the North. This was *àpropos* enough, and I profited greatly on the voyage by his hints and encouragement as to travelling cheaply and easily in Sweden. As we sailed out of the Gulf of Lübeck, we saw the Mecklenburg coast on our right, evidently composed of the same loam, sand, &c., as Holstein, and producing a similar aspect of country, like parts of England: the cottages and hedges of Holstein are much like the south of England. I found my little German there most useful, and should have learnt little without it, either at Oldesloe saltworks, or from the good Bergmann of Segeberg. The steamer was a good one from Lübeck, and we began with ten miles an hour, which was much reduced by a north wind steadily against us all the rest of the voyage. I ordered them to wake me when in sight of Möen. Up at seven o'clock, sketching the white chalk cliffs of that isle, which I hoped to visit again. To bed again. Then up, and read for some hours. Left Möen at last, and in sight of the white cliffs of Seeland, which are much lower. Those of Möen are 400 feet high, and look like the white cliffs of Dover. The first point of Sweden which I saw was the end of the small promontory of Falsterbo—low, only with a line of trees growing as it were from the water. Then the long line of the Swedish coast, and the Danish isle of Amager. Then the celebrated city of the Baltic, which, seen from the sea, disappoints one; but when we had entered it, the squares and streets were fine. Went to Forchhammer. It being a great object for me to get Forchhammer to go with me, I wrote him a letter explaining my views. . . .

May 29.—After six hours' work with Forchhammer in the museum, he agreed to go to Möen, Seeland, &c., with me. We start to-morrow at six o'clock. Dr. Beck, the Prince's naturalist, a man with whom I am delighted, accompanies me to Lund on Wednesday next, to see Nilsson. There is much

doing here, which is unknown in England and France. I am more than ever struck with the extreme slowness with which science travels, what with the multiplicity of languages, *douanes*, &c.

Copenhagen: June 1, 1834.—I have just returned from an expedition of three days with Dr. Forchhammer, in which we have travelled by land, posting upwards of two hundred English miles, first from Copenhagen to Stevns Klint on the east coast of Seeland, and then to the small ferry which separates the isles of Seeland and Möen, visiting the quarries of Faxo on our way: then to the tall white chalk cliffs of Möen. The first day was cold and rather rainy, but on the whole good working weather—the results will make alone an interesting memoir illustrated by several drawings. I have seen the junction of the upper chalk and Ciply or Maestricht beds, and satisfied myself that Dr. Forchhammer has misinterpreted the Möen cliffs and their geological relations. But the case was a most difficult one, with which I need not trouble you yet. The scenery was often beautiful, friths and bays running into the green isles; a low undulating country running in Möen into hills five hundred feet high, where the chalk is covered by splendid beech trees; cliffs near four hundred feet high, covered with wood at the summit, and with a fine shingle beach of flint at their base. My companion well informed on many branches in which I wanted instruction, and who has taught me much of the geology of regions I have just been seeing, and am to see. It opens a new world coming here, and the Danes, I find, can tell one much of Iceland and Greenland, as well as of the Baltic. The night before this expedition I went to Mr. Macdougal, who was very civil, and on my saying I was going to Dr. Beck, the Prince's naturalist, said he would go with me, as he knew him. I found Beck very strong in conchology. He has, in 'his Highness's' collection, one of the finest in Europe, if not the best, even up to the last new shells of Cuming and others in London. Beck offered to go to Lund with me, which I most gladly accepted, the more so as he is intimate with Nilsson. My scheme is to try to get some naturalist or student of Lund to go with me to Stockholm, and thus I should escape a servant, whose expenses

would be as great, and I should get instead an intelligent companion, such as Nilsson would recommend. It was strange, on returning by a different road to Copenhagen this evening, to find this capital a fortified town. Forchhammer tells me that one of Charles XII. of Sweden's dashing enterprises was to cross the ice with his army and cannon, marching down the Sound to attack Denmark, since which they have fortified Copenhagen. Forchhammer speaks and understands English like an Englishman. On my return, I found a letter from Councillor of State Adler, saying that the Prince Christian had ordered Count Vargas and Dr. Beck to attend me at his Highness's collection at ten o'clock to-morrow morning, and that the Prince had charged him to invite me to dine at the Palace to-morrow. I wish it had been any other day, for I fear I shall get late, if at all, to Forchhammer's *soirée*, where the famous Oersted, and the travellers, Pingel and Olafsen, and two other good men, whom I want to see as much of as possible, are asked to meet me.

Malmö in Sweden: June 4.—I was at the museum in the Palace at the appointed hour, and tried in vain to get Count Vargas, who was to show me the minerals, not to wait on me, as I wished to set to at the shells and fossils. I first got Beck to name the shells I had picked up; among others, a true *Neritina*, which abounds in the brackish water of the Baltic. Beck has decided that it differs from *Fluviatilis* and others, and says he has found it in the Elbe, as well as the Baltic, and would give it any name I chose, so I christened it 'subsalsa.' I was soon informed by the Secretary Adler, a gentlemanlike man, that the Prince wished to have an audience, so I was taken away from business to wait with others in the ante-room, and introduced to Baron Rumohr, also in attendance, who has written, I was told, on Grecian works of art, of virtu, and on *gastronomy*. When I had waited some time, long enough to be impatient when I thought of what I had left, I was introduced. The Prince was standing, decorated with orders, and playing the kingly part very well; good-looking rather, and of good height. He was very gentlemanlike, and said, 'I shall come to the collection when this ceremony is over, and spend the morning with you, and learn what you have made of the contro-

verted points of Möen. Meanwhile, as you are to be here one day more, I may say I only named to-day on that account; but if you have any engagement, dine with me at my country house to-morrow.' I told him of Forchhammer's party, and it was deferred till next day. He immediately sent, as I afterwards learnt, to Dr. Forchhammer and Oersted to meet me. After I had worked some time with Beck, the Prince joined us, and spent many hours while I went over the Faxo shells, an ancient coral reef, where the genera, *Cypræa*, *Oliva*, *Mitra*, *Voluta*, *Conus*, &c., had already in the chalk era begun to flourish as now in the tropics. The Prince has studied the characters of all the genera of shells. I had several presented to me by him, as we went over the drawers. When Möen was discussed, my task was a delicate one. It would have been easy to damage Forchhammer, for Vargas, Beck, and others, who thought him wrong, were glad to hail my decision, though in some respects I think them wrong also. I enlarged on the difficulty of the case, and declared that had I not studied both the Isle of Wight and Norfolk coast, I should have perhaps fallen into what I called Forchhammer's mistake. That he was ten years stronger in geology now than when he wrote on Möen. In short, I took care to do Forchhammer justice, praising also the candour with which he was now inclined to abandon opinions to which he stood so pointedly committed. The Prince then ordered Vargas and Beck to bring me out next day, seven miles, in one of his carriages, and I resumed my inquiries of Beck in the collection. Vargas is a good-humoured man, but a complete courtier. Beck called to say he was in great distress, that his wife was very ill, and he could not possibly go either to the dinner, or next day to Malmö and Lund with me. I set off with Vargas in one of the royal carriages. He told me that Prince Christian, or 'the crown prince,' has no more than 12,000*l.* a year, which there may equal twice that in England; that Adler has no easy matter to manage his finances, as the Prince could not resist when a good shell or mineral was offered. The country place was a small château, with beautiful grounds in the English style. When we entered the party was assembled. I was introduced to the Princess, a very handsome and interesting

woman, daughter of the Duke or Prince of Augustenburg, whose family will I believe reign in Holstein, if this Danish stock dies out, as is expected, when the small kingdom will be split up. She has a stately manner, yet is agreeable, and talked of my tour in Möen, &c. A German prince of Bertheim Steinfurt, related to the Duchess of Cumberland, led her out; then the Crown Prince took out the Countess Saxogeborne, princess of some house on the Rhine; then Count Moltke, who was long Danish ambassador in London, took out Countess Yule, a *dame d'honneur*; then Vargas another of these ladies; after which came Count Blücher, who is related to the general of that name, who sat next me, talks English well, and has married for love an English lady without fortune; then came Oersted, with two orders of merit decorating him. There was much laughing and free conversation at dinner. After dinner, Vargas wanted to escape, which led to an amusing scene. We all walked about the shrubberies, and the Prince pointed out to me and others the points where the trees were finest, or views best; when Vargas told me that the drive to a hill half way to Elsinore, which was proposed, would make me far too late in my packing, &c., upon which I agreed to return with him, provided he could do it with propriety. Meanwhile Forchhammer took it into his head, after talking with Count Holk, the Hof-Marschall, that Vargas was jealous of the Prince's attention to me, and Forchhammer accordingly begged Holk to take care that Vargas did not carry me off. So Vargas came to me and said, 'Now the Prince is with the Secretary Adler, answering letters—they will be for hours at it; and then comes the drive. Now I have only to get Holk to promise to make our excuses. Saying this, he led me to the ante-room of the Prince, where Holk and another were in attendance. On Vargas communicating the request, the master of the ceremonies laughed and said, 'Vargas, it is you that want to get home; go in yourself to the Prince.' An altercation ensued, with many a smart thrust and parry, when at last Holk said, 'Come, I will arrange it. There are three carriages and four, and one with two horses. Mr. Lyell and yourself shall be in the last, and when you get half way, I will contrive your retreat, and you shall be in

town by nine o'clock. Soon after this the Prince came. All were ready. Holk called up the first carriage and four, and the Prince put the Princess and some others into it, and when the three were filled, and Vargas, being summoned, had taken his place with a gracious bow as commanded, the Prince turned to me, who remained alone, and said, 'You are to go with me.' Up drove the carriage and two, and away we went, preceded by a jäger as *avant-courier*, and with a man on the box with two epaulets, and the coachman. The train followed us, and made a gay *cortège*.

Lund: June 5.—My dearest Mary, the best way I can comfort myself for the disappointment of having outrun the tardy post, and found no letter from you here, is to continue at once my journal, which makes me constantly think of you. I had about three hours alone with the Prince. He asked me to explain Faraday's last discoveries in electricity, of which he heard I was the first narrator to Oersted. He entered into it with pleasure. Then he inquired if I could explain why beeches grow best after fir, and fir after beech, in his country. I gave him Decandolle's theory of cropping, and of the matter rejected by one plant being good for others; when he said, 'I will suggest another theory. Some plants may absorb those gases and earthy matters which might poison others—time may be required to purify the soil, and then a tree of a different family may flourish.' I was so struck with his way of putting it, that I asked Forchhammer afterwards if it was not new. 'He got it,' said Forchhammer, 'from the very memoir of mine which he cited to you, but he must have thought much of it, and has put it better, and believes it is his own.' We had a splendid view from a hill, to which all walked up, of Copenhagen, the royal parks, the sea, the castle of Kronsborg at Elsinore. Then we continued in the same carriages, the Prince describing to me on the way their peat bogs, and fossils in them, mode of preparing peat fuel, after which he sent all the other carriages home, and took me to see some newly-discovered heathen tombs, huge stones from the great drift boulders of granite. He also good-humouredly stopped at a quarry of boulders, while I got out and geologised it; but while I was there he got the jäger to help him over the dike, and came too, offering his

speculations as to which blocks came from Norway, &c. When we got home, we found the rest thirsty and waiting for tea, which would not have been touched until the Prince came, though it had been midnight. After coffee, when Vargas got me off, the Prince said before them all, 'If I did not know that your curiosity was excited about this country, and that you must return to visit Bornholm Island another year, I should be unwilling to let you run away in such haste.' His lady added a civil speech, and away we went in our carriage. Vargas amused me, as his ideas are so drilled to a court. He confessed that his only reason for cutting geology was 'that it was a science for those who could afford to be *independent* in their opinions, which he could not, for the controversies led to quarrels, and these to loss of place!' But he was in manner quite the gentleman.

Lund, in Scania:[2] *June* 5, 1834.—This evening, as Nilsson is unable to see me, I shall indulge in reminiscences of my proceedings during the last two days, which I have not yet sent you. I asked Prince Christian how Sweden, having only a few inhabitants, and so little a literary country, had done so much for science. He said, 'Because the universities were endowed with much of the wealth of the church, and there is an independence for men who, if they love science, may devote themselves for life to it.' He asked me whether I lived much in London, but he added, 'I need not ask, for I suppose you still hold your appointment in the University there.' I explained to him why I gave it up. He said, 'You do well, if you can dispense with it, to do so; for after all it is a small circle you address as a *teacher* there, whereas by travelling and writing you can teach all the world.' This was all talked in French during our drive. At dinner the conversation was French and German, now and then running into Danish and English in different quarters. The Crown Prince has the character of being very aristocratical, tempered with great intelligence and information; and that he has good men always about him, Vargas being the only thorough courtier.

[2] Scania, the ancient name for the southern provinces of Sweden, Malmö, and Christianstad.

Whenever people wished to be very civil in Denmark, they began 'Herr Professoring' me, which goes for more there than even in Germany. In Denmark a title is called a 'character,' and here in Sweden I have been already asked 'what was my character?' 'When they ask me a favour,' said Macdougall, 'they say, "Now, good *Mr. Librarian* Macdougall,"' &c. Prince Christian was King of Norway for a short time, and would have remained so, had not the Norwegians been constrained by the Allies to be bound, much against their wishes, to Sweden. 'There are twelve courts to keep up,' said Vargas; and then he enumerated the different brothers or near relations of the King and Crown Prince who had establishments. The young Prince who is banished for a season to Iceland is a son, by a former marriage, of Prince Christian, and the mother is separated, and at Rome—*mad*, as her son is thought by many to be at times. So was the father of the present King an avowed madman, although it is a fact that he was named guardian of the Duke of Ploën when he went mad, together with two other guardians, the Emperor Paul of Russia and George III. of England! The young Prince is twenty-three, and married several years, without children. After him Holstein would be separate. As the monarchy is the most despotic in Europe, the coming to the throne of such a man would of course be a calamity. Some say it is in prospect of this that the present King and his councillors have wisely given a sort of form of a constitution, which was proclaimed the very day, May 28, our steamboat arrived at Copenhagen, but without exciting any feeling. It is, however, a very important event, as it appoints four places, Holstein, the Isles, Sleswick, &c., where deputies representing the people are to meet; and though they are only to consider provincial matters, it is a *beginning*, and they will be the organs by-and-by of a legal reform if the country is pushed by a madman to a revolutionary movement. Good men, therefore, hail the gift with satisfaction. Meanwhile the King has retained absolute power. He is much liked and respected. 'He *was* liberal,' said Oersted to me, 'and we cannot accuse him of having changed; but the times have changed, and have now gone far beyond him.'

Our late return from the country palace called 'Sorgenfrey,' or 'free from sorrow,' made my packing rather hurried, and I should never have got through it before the packet sailed, if I had not got the assistance of a *laquais de place* who talked English. We sailed over the Sound to Malmö in about five hours very pleasantly, though the boat was so small, that had it rained or been rough, it would have been wretched. The low island of Salholl was on our right nearly all the way. A Danish naval officer who talked English helped me, and I got successfully to a humble inn at Malmö, and walked on foot along the shore to the lime-works at Linnhaven, and back in a peasant car, filled with dry seaweed. On the sea-side I remarked the extremely small size of the *Cardium edule* and *Mytilus edulis*, which I have since learnt is characteristic of all the truly oceanic species which contrive to live (both fish and mollusca) in the brackish waters of the Baltic. They miss their proper dose of brine, and the farther from the Sound the smaller do they become.

Hurfra : June 8.—I must return to Malmö, where I began to feel the want of the language (even at so flourishing a port where the English trade) a very serious inconvenience. As to transacting the bargain of a carriage, my courage misgave me, when in stepped a gentlemanlike sort of a young man, talking good English, and introducing himself as Mr. John Robert Johnson of Malmö, a Swede, whose mother was English, and offered his services as interpreter. I liked his manner much, and after purchasing with his assistance a covered carriage on springs, with harness included, for the moderate sum of about 9*l*., taking it first upon trial to Lund, I asked him if he would go to Stockholm. He said he should be glad to try and arrange it, so he went with me in the light carriage to Lund, and on the way told me his history. His father died when he was a boy, and the widow kept the English Hotel at Stockholm. She was soon ruined by the knavery of the waiter who managed the inn, and was then invited by Mr. Dundas, a Scotch gentleman who bought an estate near Lund, to be his housekeeper, which she was for five years, when she died. Her only son, who was thirteen, upon this quitted Stockholm, was first sent to school, and

then to study at the university of Lund, being intended for the Church; but becoming rather deaf, and expecting to get worse, he gave up the idea, and became teacher of the English language at Malmö, where the Swedish merchants have need of a teacher, and keep him to it ten hours in the day. I was referred to Dundas, who was hourly expected in Malmö, but having consulted a Malmö merchant on whom I had a (letter of) credit, I felt no fear. After talking over the matter at Lund with Professor Hill, a chemist, I offered Johnson a little more than I should for a servant, and his expenses back to Malmö, which he agreed to joyfully, requiring nearly the whole in advance for outfit. He returned to Malmö to pay for the carriage, being absent only two days, which I spent most agreeably and profitably with Nilsson. He showed me his fossils, and gave me a valuable collection of duplicates. We made an excursion together through a country of greywacke with orthoceratite limestone and schist, containing a curious zoophyte called graptolite in great abundance, and a few shells. These rocks are seen by the banks of a small brook in a place called Fogelsång (pronounced song), or 'song of birds,' where I heard the nightingale and cuckoo. The vegetation was superb. It was here that Linnæus first studied botany when a student at Lund. I had often wondered that in his tour in Lapland he contrasts so much the plants and insects of the northernmost climates with the south, thinking that Sweden was far north; but Scania is like England, splendid woods of beech and oak, and flowers innumerable.

Körby.—We have just made another stage from Lund of nine miles, and are waiting a few minutes while a blacksmith mends the tyre of the wheel of my *bargain*; but really the machine promises well, and will I hope sell for near what I gave for it, so as to cover any extra expense of Johnson, who comes on very well.

Nöbblö.—Another stage, and in danger of waiting an hour for horses. After Christianstadt I suppose I must have a forebud.[3] The country to-day from Lund by Hurfra, Körby, and Wren to this place is like England,

[3] Forebud—a Swedish term for a messenger or *avant-courier*, sent on to order horses from stage to stage.

and scarcely what I had expected. The fir trees have been rarer I think than even in the south of England, and oaks and beeches and a variety of other hard wood of handsome size have been spread over a country much like the New Forest, with the same glades opening here and there, but greener and much less heathy in Scania, and with the difference that the country here, though hardly more hilly than Hants, is strewed over with innumerable blocks of granite and other crystalline rocks, so as sometimes to resemble the Forest of Fontainebleau. The weather delicious, roads good, though not quite equal to England. It is most creditable to the Swedes to have made such roads without turnpikes. Every here and there are gates opened by children, who are pleased with the sixth or even twelfth part of a farthing. The juniper has been nearly as plentiful to-day as heath in England or Scotland. All the floors of the rooms are strewed with it. Between Hurfra and Körby we were for hours in sight of a noble lake, by the side of which are several country seats of noblemen and gentlemen, which look much like England. I went to the shore of the lake, and found it covered with stones, on which were abundance of the common *Succinea amphibia*. A squirrel was sitting on a great stone close to the road when we passed: it played about when we were very near, and looked at us. I saw a great many bogs, as in the New Forest, and horses feeding in them up to their knees in mud.

Christianstadt.—This is a neat fortified town; horse artillery exercising; passport demanded for the first time. Stopped at the gate while a blacksmith repaired the iron of the wheel of the carriage. Symptoms also of one spring of the said vehicle letting one side of our seat down a little; but it runs well, and in this cheap country the two repairs, which at Strasburg might have produced a heavy bill, were only 2*s.* 2*d.*

Karlshamn: June 10,—Johnson comes on very well, and is an excellent whip. After Christianstadt I made an excursion quite out of the way to visit the lake of Ifösjon, in the middle of which is the isle of Ifö (pronounced Ivon), where beneath the sand and boulder formation, under which in general the country is buried, appears in steep cliffs a calcareous green

sand of the chalk era, with numerous belemnites, some oysters, and a few cranias. Of the belemnite, a species—which I believe is only Swedish—was so plentiful that I filled some small boxes full. Getting boats and cars for this expedition, and waiting for each, cost much time. There is a village on the isle, which is rich and beautiful, and we found an intelligent clergyman, who insisted on our dining with him, and while his horses were sent for to take us to a cliff, his daughter, who had waited at dinner, played from a book some pieces on a piano, with a kind of flute accompaniment, for it was half an organ. I cannot say much for the melody. The priest, as Johnson called him, has the reputation of speaking many languages, but he knows nothing but Swedish. I tried him in vain in Latin. He gave me a fossil or two, and offered me some stone hatchets. Before Christianstadt we passed a huge block of granite, as large as a good-sized house, which even in this country of boulders is a wonder, and is called the phantom stone 'Trollesten,' the subject of many a legend of witches.

Karlshamn: *June* 10, 1834—I mentioned the Trollesten in my last. When talking of those legends we asked the innkeeper whether the peasants about him believed in the 'Brook-horse,' or 'Bäcke-hästen,' pronounced Bake-hasteten, the *e* in the first word as in German. I had seen in the morning many horses and pigs up to their middle in the Scanian bogs, feeding, and thought how elephants of old and other cattle got mired for the benefit of our modern anatomists. This evil spirit corresponds exactly, I conceive, to the water-kelpie. The host began by saying how rapidly all these superstitions were disappearing; and then confessed that very lately, when a cow of his was put out to grass, and came home lean, and with her back rubbed and raw, nothing would persuade his servants that anything could be done for the beast. It was the Bäcke-hästen which had been riding it: there was nothing else the matter. This demon tempts the cattle into mires, and the peasants after them, and carries them out to where they sink, and drives the cattle, &c. Among other stories I am told that, as finding of buried treasure is of no uncommon occurrence still, there are some persons gifted with a magic glass, which,

when they take it out with a lantern at night, shows them where the hidden money is. If anyone gets unaccountably rich in trade, &c., it is attributed to his having a glass. But as dragons guard the treasure, it is dangerous to take it. If you ask what sort of dragons, they say like the great wooden one in the church at Stockholm, which St. George is killing. About four years ago, a live alligator in very good condition was found in the fields near Lund, and was taken by the peasants for one of these dragons; so that it was not till they had collected in considerable numbers that they ventured to seize him and carry him to Lund, where he now appears in the museum as a stuffed specimen. Malmö, the nearest port, was twelve miles off, but he is supposed to have swum ashore from a wrecked vessel at Helsingborg, thirty miles off, his line of march being traced by the slaughter of geese, which had been attributed to the unusual rapacity of the foxes. As it was the heat of summer, the creature had probably formed a tolerably good opinion of Scania.

I give the story as told me, but unluckily did not hear it before I left Lund, so could not get from Nilsson an authentic account. We get on very slowly, though the roads are good, but the delays are so numerous. They often send the merest children to bring back the horses, who have hardly strength to hold the reins, so it is fortunate I have a good driver as a companion. For three years he was a probationary preacher, having, as is usual, obtained leave from the bishop to that effect. My collection of belemnites excited much curiosity. In the country where they are common the people call them candles, saying that the witches burnt them. When transparent, they are not very unlike the amber so common on the shores of the Baltic.

Höby : June 10.—It seems to me we shall never get to Stockholm at the rate we move on. We have only yet met two other carriages since Malmö—posting. I only wonder the inns are so good. What a vast country this is! Bläking is very beautiful, granite covered with wood, and blocks of granite among the trees. The rye bread is sometimes nearly white, and sweet and palatable. Along the road are black painted boards, with the initials of the peasant who is to keep

it in order. I should be quite lost without an interpreter. Johnson is a perfect gentleman in his manners and feeling, and, when we were with the priest's family in Ifö, played his part admirably.

June 11.—Yesterday we slept at Rönneby, a Swedish watering-place situated in a picturesque granite country. Nilsson had begged me to inquire about the discovery of shells near the river at Rönneby, which I did from a fine old clergyman, whom they call the Dean, and who is much respected for his learning. Dean Weltergrund visited the spot with me, and cross-examined the men who dug the trench. This morning we were off by half-past six to Karlscrona, where I failed in seeing the docks, which are not shown to strangers. They are said to prove that the sea has not fallen there. The northern part of Bläking, which, like Scania, once belonged to the Danes, has afforded the first fir woods I had yet seen. The juniper is very ambitious there, and aspires to be a tree, rising sometimes to near fourteen feet; and putting aside its shrubby, bushy growth, it is then quite handsome, a sort of northern cypress. We have also passed some woods of birch, but never saw large trees.

Kalmar: *June* 12.—To-day I have been examining and taking a sketch of the ancient castle here, now a prison, and it affords proof, I think, of the very slight, if any, change of relative level of land and sea since 500 years. It is a fine old castle, and stood many a good fight with the Danes. We saw the hall in which the treaty of union of Sweden, Denmark, and Norway was signed. I have been about the latitude of Edinburgh and Fife, and the climate and natural productions seem very similar. We have had no great heat nor cold, but the best kind of weather both for travelling and working. I am just returned from an examination of the beach. It seems as if the Baltic, being neither good for fresh nor salt-water shells, had not yet received a peculiar brackish tribe of its own. I only found a few small cockles and mussels, one *Tellina Baltica* and *Lymnea ovata*? the latter alive and in abundance.

June 13.—We are penetrating into the interior from Kalmar. All the houses have been of wood, almost through

our whole route, even in many towns. It is a great country of peasants, all of whom have a little land. They invariably take off their hats as they pass us. This morning some poor children brought out each of them a pottle of fine ripe wood strawberries, to sell for a halfpenny each—the baskets ingeniously made of the bark of the birch sewn together. With rich cream at the post-house, and some sugar, we had a fine dish for two, for twopence halfpenny. We are now passing numerous lakes, in a flattish granite country, covered with fir wood, and here and there a piece of better land with rye upon it, fenced in with fir fences. I have just got a new light in regard to good roads and cheap posting. The peasants, it seems, hold their lands upon the tenure of keeping the roads in order, and providing horses. This last, though paid for, is generally looked upon as a tax, and only on some roads, where they are very poor and the travelling frequent, do they profit. They take turns in turning out steeds, which are sometimes taken from the plough. This is a sort of feudal service, and the traveller is admitted to share the privilege of a 'lord superior,' and have the services of his vassals.

Norköping.—Yesterday I pushed on about a hundred miles, finding the horses always ready, but I was on the road from five o'clock in the morning till half-past nine o'clock. A country of rock, fir wood, and peasantry. It seems to me that I have never seen a shop since I entered Sweden. Even at Linköping and this place there only appeared things to sell in one or two windows. I have not been at all annoyed by dirt, but then I am not always inquiring for it, *à l'Anglaise.* Twice I have been slightly bitten by the insect tribe. To-day I went a round by Berg and the west side of Lake Roxen, to visit limestone and slate quarries. The locks of the great canal, which are the wonder of Sweden, appear nothing to an Englishman. The cost, however, was severe on this poor country. The numerous smaller lakes of Ostergothland reminded me of Windermere and the English lakes. The rooms are strewed here with the leaves of the birch tree. Every room I have seen in Sweden is strewed with this, or juniper, partly to scent the rooms, and in part to conceal dirt on the boarded floors.

CHAPTER XVIII.

JUNE–DECEMBER 1834.

STOCKHOLM—BERZELIUS—REVIEW OF THE FLEET BY PRINCE OSCAR—UPSALA—HERR ADJUNCTER MARKLIN—LINNÆUS'S GARDEN—LIBER ARGENTEUS—MEASURES THE SEA-LEVEL—RETURNS TO STOCKHOLM—GOTHEBORG—SAILS TO HULL—EDINBURGH SCIENTIFIC MEETING—AGASSIZ.

JOURNAL.

Norköping: June 15, 1834.—It is now twenty-five days that we have been separated, and I have often thought of what you said, that the active occupation in which I should constantly be engaged would give me a great advantage over you. I trust, however, that you also have been actively employed. At leisure moments I have done some things towards planning my next volume. It will be necessary for us to have a work together at fossils, at Kinnordy first, and then in town, and then in Paris. When at Kinnordy, if you could get some disciples to teach them fossil conchology from Deshayes' work, it would be a great step. I picked *Lymnea auricularis* out of the Gotha Canal, where it flourishes, as at Poppelsdorf. I find that the work at the loëss shells has made me acquainted with nearly every freshwater and land shell I have yet met with here, which is encouraging. Nilsson gave me his little work on the shells of Sweden. When I consider how thinly the population is scattered over this vast country, and that rich natives and foreigners are passing along the high roads, and that the woods contain no robbers, I am lost in wonder. But then every peasant has something; there are scarce any paupers. The peasants drive along in their light cars, with loads of deal planks, at the rate of six or seven miles an hour, and often

kept up with us. They are a well-grown race. We saw a great number of jays in the woods, and I observed some insects which are common in the south of England, such as *Papilio rhamni*, which do not go so far north as Scotland. It is enough that they have a little very hot weather, and they care not for cold, as they can be dormant. If I had not seen them, I should hardly have thought that it was hotter here than in Scotland in summer. Much rain in the last two days, but only in showers. Drivers spoke with glee of ten cubs of wolves just caught, but no old one taken.

Stockholm: June 19.—I have been two days in this capital, and like what I have seen of it much. But before I begin upon it, I must endeavour to fill up my journal. The Norköping steamer went first smoothly down the river, the same which drains off the surplus waters of Wettern, and several other lakes, banks covered with fir, and islands and a broad river. Scarce anything but wood and rock. We came in a few hours to the open sea, and a gust of wind caused a swell, which made the ladies ill. They were merchants' wives and daughters. After a few hours of this we entered a passage between an endless string of islets and the mainland. The water here smooth as a mill-pond. We passed swiftly on in deep water, close to the rocks, on the barest of which are a few firs in the clefts. These are evidently the summit of submarine mountains. We then in the night came to the Södertelje Canal, which joins the sea and Lake Mälar. We had to wait here several hours till the lock was open, and the time was spent in taking in wood.

No. 4 *Norre Smidje Gatan* (*North Smith Street*), *Stockholm.*—While we slept, a quantity of fuel was taken into the boat, not black, dirty coal, but sweet-smelling fir wood, which never makes the least smoke from the chimney that was visible, and leaves the sails quite white. Early in the morning of the 17th the gate of the lock opened, and we ascended into the lakes.

The banks of the lake were of granite, covered with fir and some oak and birch; beautiful, yet perhaps somewhat monotonous, after the similar scenery before, until the fine

city of Stockholm came in view, so superior in its site to Copenhagen, from the uneven ground on which it stands, and the numerous deep friths which intersect it, and the strong, deep current which runs out of Lake Mälar through it. The inns were full, but I soon got a lodging here in a good central place. Went to Berzelius, and had from him a most kind reception, and to business at once. 'You have time to do much,' said he, 'provided you can escape *dinners*.' He went at once to the point, and having told me much that he knew about changes of level, offered to drive me next morning to some interesting spots in his drosky. He also introduced me to the keeper of the Museum of the Academy Royal of Sciences, of which he, Berzelius, is the head, or secretary; and they find him a good mansion, and I suppose a salary besides. He lectures on chemistry to the College of Physicians. He was the son of a priest, of a good family, educated for medicine, but never practised it, but early devoted himself to science. Was ennobled by the present King, without any title, except some orders, which however are only appended to his name, as he is still 'Professor de (af) Berzelius.' He has officiated in the Chamber of Peers at some Diets, but tells me he has cut politics, and a Peer may, when the Diet opens, declare whether he will or not act in it. The present Diet is an extraordinary one, called by the King to convert the paper circulation into coin. The bank-notes descend now to the sum of three-pence English! and are almost all in rags. On the morning of the 18th I spent five whole hours with Berzelius, *tête-à-tête*. After all kinds of hints, which I noted down for my tour, he drove me to see some alluvial phenomena near the Observatory, and in the beautiful royal parks a few miles north of this city, of Haga and Ulricsdal, in both of which are fine lakes and woods and country palaces. Then to Solna, where marine recent shells are found some thirty feet above the sea. Berzelius entertained me with results of his last analysis of meteoric stones, which he believes come from the moon. While I made drawings, and collected specimens, Berzelius gathered grass for his well-fed and handsome dun pony, which he is great friends with, and can leave him quite alone. 'As he only gets hay,' said

Berzelius, 'all the year in the stable, every mouthful of this is a sweetmeat to him.'

Stockholm: June 21.—After I came home from my ride with Berzelius, in the middle of the day, I dined at the Club, or Society, as it is called, a handsome building overlooking the ström, or grand current which issues from Lake Mälar. Here some of the gentlemen helped me to order dinner, which only cost about a shilling, beer included. Afterwards to Colonel Blom, who drove me in his carriage through the 'deer park,' to show me this royal park which is open to the public, in which he, Blom, has erected several of the 'transportable houses' of which he was the inventor. They can be put up in a few weeks anywhere, well heated with stoves: are made of wood, painted with oil. The King had one in a great hurry once, to give a *fête* in the park, and was so pleased with it, that it is now cased in stone, and forms a country palace, of which Blom gave me a drawing. On the 19th I saw Hisinger for the first time, for he is much taken up with committees of the Diet. He is oldish, good-humoured, but has withal rather a *triste* manner. I expected more of a devotee, and suspect it is an unfavourable time when a man is worked with political affairs. I got an old plan of Stockholm from Blom, and we went through Professor Johnston's article in Jamieson[1] together, whose proofs of the fall of the water here are so bad and exaggerated, and some of them absurd, that it is enough to provoke scepticism. I determined next day to examine the spots, which Professor Johnston cannot have done. I was introduced by Blom to Lieutenant-Colonel Lundstedt, who replaces Hällstrom, whose absence all are regretting, for my sake. Next day (yesterday) I went with my interpreter in a *calèche* to all places cited in the article in Jamieson's Journal, a beautiful drive, and satisfied myself that, though the water may be falling, most of the historical proofs adduced are ridiculously nugatory. One case for example. Charles XI. built a fishing lodge 150 years ago, which stands thirty feet above water. This *near* the lake, but now far from it, and high above it; but I found a great oak, which

[1] Jamieson's *Edinburgh Philosophical Journal*, 1833. On the Rise of Land in Sweden, by J. F. W. Johnston, F.R.S.E.

is upwards of two hundred years old, and which I measured, and of which the base is eight feet only above the lake. This oak then loved the water 150 or 200 years ago more than our willows do now. The hut must have always been, within a foot or two, as far from the lake as now. I spent two hours with Hisinger, who gave me four volumes of his works, with some plates and maps, all in Swedish. Read Swedish for the first time one hour with Johnson, who teaches pretty well.

Stockholm: *June* 22, 1834.—Stron, the Keeper of Woods and Forests, has offered to measure the height of Charles XI.'s oak, and has sent me in his reasons for saying it is four hundred years old, and much more valuable information. I am now in hopes, by the altitude of this tree, to fix a limit to the possible rate of the rise of land here. I must stay here a day or two more. A new man, Col. Nordewall, comes into the field to-morrow, willing and able to serve me. Berzelius says: 'I see you will extract what I could not get him to print, because he will see that you must have it at once, and he is a procrastinator.' This is justly called the Venice of the North, and now the sun is powerful, though hitherto the weather in Sweden has been delightful. Prince Oscar, who is Lord High Admiral, is to review the fleet to-morrow, and it has come into the suburbs, and four or five ships of war, among them one good-sized frigate, have actually cast anchor opposite the windows of the palace, such is the depth of these blue friths, which are yet so narrow as by no means to detract from the height of the houses. The bronze equestrian statue of Gustavus II., and those of other kings in the squares, are in a superior style. I shall only hear the cannon at a distance to-morrow, as I am determined to go to Södertelje again, and next day to Upsala. I have fully determined to return to Stockholm after a tour to Gefle, and a little to the north of Gefle, then Fahlun, Sala, and here. I am making myself master of the kind of evidence relied on for the change of level of the Baltic, and it is necessary to cross-examine both nature and man. The testimony of the former is strong; of the latter, I must say, so weak and contradictory, that I require to know the men, and find how they got their views. I must

endeavour to see Hällstrom. Old Nordewall stands me out that a bed of *Cardium edule*, 100 feet high, proves that the *fresh water* of Lake Mälar was once that much higher.

Your letter came to-day, and was most welcome, and better than the *fête*, for which I partly stayed, knowing that Johnson thought it a sin to be out of town. In its way it was fine. The troops, both Swedes and Norwegians, well-grown men. The parade very fine. The ships of war opposite the palace covered with gay flags. Afterwards the yards manned. All over in a short time. I afterwards drove in a gig to talk with Berzelius, then to Nordewall, then to the suburbs.

Upsala: *June* 26.—The Södertelje expedition told more than anyone I have made in Sweden. Shells of the Baltic nearly one hundred feet high. All that I got at Lübeck save *Mya arenaria*, and perhaps that is not a Bothnian Gulf species. But what think you of ships in the same formation? —nay, a *house*. It is as true as the Temple of Serapis. I do not mean that I discovered all this, but I shall be the first to give a geological account of it. I came home in high spirits at this prize, and the chilling influence of old Hisinger was more than thawed. I think I have hit on his character. Sweden is his preserve, and he wants no young poachers. If you ask for instructions to such a place, he will say, 'Oh, that is all known already.' I told Berzelius of what I thought of Södertelje, and he was not staggered at my requiring an enormous subsidence and re-elevation. Had Nordewall or Captain Cronstrand only known that neither a *Cardium* nor a *Tellina* will live in a lake, it would have saved them a world of trouble.

Upsala: *June* 26.—We were sent off from two inns, and this, into which we have found our way, seems excellent and full. I went to bed without candles last night, after eleven o'clock, and happening to wake at three o'clock, found it daylight. This I believe is about the latitude of the Shetland Isles, yet a nice summery-looking land in this season. In a stream to-day, slow flowing, I found numbers of *Planorbis corneus*; at Lund, *marginatus* was equally abundant.

June 27.—Wahlenberg exceedingly polite and gentle-

manlike, but seems sickly, which some here attribute to his being a martyr to the homœopathic system. As he is now full of botany, he handed me over to Herr Adjuncter Marklin, an assistant professor, who was a peasant, and only began to read and write at the age of twenty-one. Very simple. He tells me he has only 17*l.* sterling a year, but never sells fossils or other things: an enthusiast, full of knowledge and originality. I have learnt much from him already, and on finding he was delighted with Rang, I gave it to him, and he has given me duplicate copies which he had of Dalman and Wahlenberg, on trilobites, and has presented me with shells collected on the coast of Norway, and with some transition fossils of Sweden, of which his collection is beautiful. We talk German together, and regularly have recourse to Latin when either of us are at fault. He is about fifty, and when I mislaid my gloves, he remarked that he was fortunate in *never having had any*. I should not be surprised if they who search for the shirt of the happy man, should find no such incumbrance on him. Certain it is that when the City of Frankfort offered him four or five times his present income to be keeper of their Museum, &c., he declined, partly, he confessed to me, because the German *diet* makes him ill. He has a collection of insects, in which this country seems very rich, having many species which we consider more southern. I have been with him through Linnæus's Garden, where the hedges of fir, clipped, stand as he planted them (*Pinus abies*). Linnæus had five children: the son died young, and all but the eldest of the four daughters are married. They are much delighted at foreigners coming to see the house in which their father lived, especially at Hammerby, in the country. I may perhaps have scarcely understood part of the story, but Marklin was speaking of some Englishman who obtained from Miss Linnæus the cups out of which the old gentleman drank, and sent in return from England a service of plates with the *Linnæa borealis* painted on each article. I saw his lecture-room, and Wahlenberg showed me his statue in another place. There are nine hundred students here.

June 28.—Besides zoologising yesterday at Marklin's, I went to the hill, a hundred feet high, on which the tower

stands, to examine marine shells. All of Baltic species. You remember that in the half-hour between the two steamboats at Lübeck, or rather Travemunde, I collected shells by the quay. Not one fossil have I found newer than the chalk in Sweden that was not in the number of those found living, in that half-hour. To-day, after studying with Marklin, I saw Col. Bruncrona, chief of the Swedish pilotage for many years. I am to get some hints from him to-morrow, I hope, about the marks at Gefle. Tornea (says Wahlenberg) is not so well worth examining as Gefle for this point. Afterwards I went, at Wahlenberg's recommendation, to Ulfva, three or four miles off. I went in style, with my driver, my interpreter Johnson, and, thirdly, my *naturalist* Marklin, and a good pair of steeds to my carriage, which after, on the whole, about four guineas repair, seems fit to go the world over.

June 29.—I have learnt much geology here. It is fine agreeable summer weather. Linnæus's Garden looking very like one in Hampshire, and no signs of a latitude north of Cape Wrath.

June 30.—I am stopping at a house in a fir wood, between Upsala and the great iron mines of Danemora, while horses are sent for. Nothing could have *told* more than my stay of three days at Upsala. I have got a date for some of the largest erratic blocks, and shall quite overset the *débacle* theory, and I expect bring in ice-carriage as the cause. I hope to stay two hours only at Danemora. My point now is to examine several places where marks were made in the rocks about fourteen years ago by Bruncrona. One of these is near the port of Oregrund. I had a famous elementary lesson in trilobites from Marklin, and wish you had been there. All the recent animals most analogous were put before me, and the principles on which the fossils have been classified explained. At Ulfva I found recent Baltic shells in clay. I visited on the way home Gama Upsala (Old U.), where there is a church, in which Marklin says the Catholic worship was for some time performed in one part of the ancient temple, while the heathens sacrificed human victims to Thor and Odin in the other. Near the church are three immense tumuli, in which those two idols, and

Frigga, Odin's wife, were buried. It is the custom to drink a glass of mead (honey and wine, or spirit from barley, I believe) on the top of Thor's tomb, and as the King had lately done so, said the peasant who drove us, he supposed I should, which accordingly we did. The beverage was not bad. The tradition of the joint worship is believed. The priests of Odin and Thor have taken advantage of a natural ridge of sand and gravel, and by cutting part of it into gigantic hummocks, have skilfully enough given the appearance of a stupendous work. This was a trick worthy of some of the Catholics who supplanted them. The iron mine at Danemora is a grand sight, but for want of a good guide, whom I could understand, I did not gain much, and there appears to be no interesting geological phenomena to be seen there. I am beginning to tire of fir woods again, though now and then varied by birch. It has been rather monotonous, whereas between the capital and Upsala it was much the reverse. It is a *détour* of a day nearly that I am making to Oregrund, to see a mark in the rock. I had a very pleasant walk with Wahlenberg to see a meadow near Upsala, where several marine plants, as *Glaux maritima*, which require salt, still flourish. The sea does not come nearer now than Stockholm: there is salt in the soil.

Oregrund: July 1.—A nice little port, with ships lying at anchor. Just returned with the Lieutenant of the Pilotage from the first examination of marks in the rocks. Results, as far as our observation goes, very decided and satisfactory. I am exceedingly glad I came here before Gefle. I think of making a report to the Royal Academy at Stockholm. Went in a boat about three and a half hours' pull, with four rowers. The place of the mark, and the mode of marking, well chosen. I had with me the pilot who made the mark fourteen years ago. It seems true, as Galileo said in a different sense, 'that the earth moves.' I found a *Neritina* on the rocks where the mark was, four specimens. We are just going to set off on our way to Gefle, through more fir woods. In these woods the quantity of ant-hills at the foot of the fir trees is quite extraordinary, and of great height, but scarcely, I think, larger on the whole than those in the New Forest, only higher. I have been determining that in

October, while I attend Daniell's lectures, I shall go on with zoology steadily, and we will study together. In a day or two, my dearest love, I shall be again turning towards you, and with the satisfaction of having accomplished the object of my journey, and with having, I am sure, reaped the fruit of the sacrifice we have both made in the separation, so far as my scientific career is concerned.

Gefle : July 2.—I forget whether I told you that at Upsala I saw the famous Liber Argenteus,[2] of which I fancy you read more than I could tell you in Clarke and elsewhere. I have found a new locality for Baltic shells. I begin to have great hopes that I shall feel strong enough in original matter and in decisive results to read my paper to the Royal Society.

Fahlun : July 5.—I had the chief pilot at Gefle for a day and a half, and visited two of the principal marks made in 1820 at Löfgrund and Esjko Sound. A retired sea captain of Gefle volunteered going with us. He had traded much with Hull, and has the reputation of knowing English well, as he was so much in England. Partly not to expose his great ignorance of the language, and partly to please his own reserved humour, he hardly uttered a word the whole time ; but he was so good-humoured and willing to do just as we liked, and to help to steer, &c., that we were as well with him as not. The first day it was very cold, with the wind against us, and slow work. I learnt much about the action of ice in these seas from the sailors and pilot, and we landed at Löfgrund, and drank milk in some summer fishing huts, where we found a nice peasant's family. I measured the stone at Löfgrundet, where there was one mark made in 1731, several feet above the sea. One of the fisher huts had been broken to pieces by the fall of a fir tree upon it. We next landed on the island of Edskö klubb, but could not hear news there of a mark which the pilot thought there was. Then I measured the line cut on St. Olaf's stone in Edskö Sund, and, it being late, determined to sleep there. The accommodation was scanty enough, but we had taken provisions with us. I slept well for four hours, and then

[2] The *Codex Argenteus*, containing the four Gospels in silver letters, a MS. of great antiquity.

waking, and seeing the sea quite calm, I got up, woke the pilot, and told him that as he said the evening before that my observation was incomplete from the state of the wind and sea, perhaps we now had a good opportunity of rectifying it. He was a sprightly, good-humoured young man, and very intelligent. He immediately jumped up, and declared that the sea was in so favourable a state, just at its mean level and quite calm, that no time should be lost. With great despatch all the things and his men were ready, and the old captain, who was never so happy as when sitting in the boat, was down among the first. As for Johnson, who sleeps hard, as he says, he was bundled out of bed, wondering that 'having ordered coffee, I should go without it.' Away we rowed down the sound, and revisited the huge stone, and I found the sea, as the pilot had predicted, several inches lower. I returned then to Gefle, much pleased, having gone about forty miles by sea in our excellent boat, and which sailed very well against wind. Had I taken a common fisher boat, I might have been beating about three days or more. Got off the same day towards Fahlun, and penetrated farther than I had ever done before into the *interior* of Sweden. A land of goats, none of which I had before seen nearer the coast.

July 6.—Johnson, who gets on in many respects very well, is so slow at getting up in the morning, that I have taken up the thing in earnest, having lost on the whole journey several days by want of method in posting. I have ordered the carriage to be greased over night, and have got up some phrases in Swedish, to order the man myself. He is astonished to see already the difference; but I will show him yet, when I have a few more words, that we can do a stage at least more in the same day's work, for when the horses come he has a number of things to do, and the bill is never paid. We are now stopping at a stage between Fahlun and Sala, having crossed more than once the Dal Elfven, one of the largest rivers in Sweden, of which we have seen much. I suppose I mentioned that, at Skjerplinge, the falls of that great river over the granite are very grand. Niagara in miniature, I suppose; but the island covered with firs which divides the waters is beautiful. The people of Dalecarlia,

which we entered yesterday, are a fine-grown race, and the cottages of the peasants quite handsome. Wood painted red, with very large panes of glass in the windows, and good stoves in the German style in every room. The beds look poor and not perhaps (except the sheets) very clean ; but I sleep sound, am rarely bitten, and on the whole find the plain diet agree with me.

6, *Evening.*—I have just seen the great silver mine. The metal is in a beautiful rock of crystalline limestone.

Stockholm : 7.—I feel now what I was very sensible of when correcting my last edition, that I was not justified in writing any more until I had done all in my power to ascertain the truth in regard to 'the great northern phenomenon,' as the gradual rise of part of Sweden has been very naturally called. You will see by-and-by how important a point it was, and how materially it will modify my mode of treating the science, and how much it will advance the theory of the agency of existing causes, as a key to explain geological phenomena. I should much like next year to find Deshayes' manual just coming out, or just finished. My plan is to take up by degrees the zoology of geology in all its branches, but to make shells the great business.

To LEONARD HORNER, ESQ.

Stockholm : July 9, 1834.

My dear Horner,—I shall be at Hull, unless some unforeseen obstacle occurs, by the packet which should arrive there on the 25th of this month. I am longing for Mary's company again, and hope to join her just within the ten weeks, or seventy days, which, as Mr. Kennedy told her, was a generous concession in her to make, by way of leave of absence. The sacrifice any other way would have been great, for to do what I have, would have required nearly perpetual absences, in boating excursions and others, and much roughing on the road, which I have not felt, because not only excited, but in the field all day. But the country inns and poor peasants' houses would have been wretched abodes for a woman, unable to keep up with the geology. I have seen a glorious country, and have examined many of

the marks made in 1820, all now some inches *above* actual sea-level. The observations may be slighted by some, because this sea rises and falls two or three feet in the course of the *year*, but when the season and other circumstances are taken fairly into account, it has made on me a strong impression. My interpreter has enabled me to cross-examine pilots and merchants and fishermen. Another line of research has been the huge drift blocks, or Baltic boulders or 'erratic blocks,' which cover all Denmark and Sweden. Their size is often enormous. Some I have ascertained have been placed where they are in times exceedingly modern, geologically speaking, certainly late in Newer Pliocene period. I believe that ice has brought them. I have questioned the pilots closely about the agency of ice, in which they believe. I am persuaded that ice can do much for us. The examination of Baltic species of shells above the sea-level at various heights, some at new localities which I have found, is a grand fact. I have still to see Uddevalla. I was glad to hear that you had been *fishing*, or lizard catching, with Lord Greenock, who has that greatest of all merits, loving the subject. The Swedes seem to me more like the English than either the Germans or French. They have most of our faults and merits. Not so many simple characters as in Germany. The heat is now very great here, and Stockholm looks almost like an Italian city, and feels like it. I have had nearly constant dry weather, scarcely three days with any rain, which, with only three hours of night, has enabled me to do much in a short time. I think of writing a paper for the Royal Society on the elevation facts, and for the Geological Society on Danish chalk.

I have not said in my letters to Mary that I have looked in vain for any fine natural woods: all the large old trees are cut down, even where the country is fully wooded and a continuous forest. I have visited the greatest copper mine of Fahlun, of silver at Sala, and of iron at Danemora. I cannot say that they have edified me much as to the causes of the metallic phenomena, but I was ill prepared to profit by them. The silver occurs with lead in an enormous mass of pure crystalline saccharoid limestone, not got through, at the depth of 180 fathoms—the calcareous mass in the midst of

gneiss. I am glad to hear Mary is looking better, and hope it will be some years before I shall be called to settle any other point in the northern regions, for settled it is as far as my private opinion goes, and that I shall make future tours with her.

Believe me, your affectionate son-in-law,

CHARLES LYELL.

JOURNAL.

Stockholm: July 10, 1834.—An expedition with Colonel Hällstrom, to see one of the Baltic shell beds of Bränkyrka, never before examined by any geologist, proved remarkably how much it is necessary to know what to look for in order to find. Hisinger said, 'As you have seen Södertelje, and other places, what do you expect to find more?' I answered, 'Either I shall find the freshwater species which now inhabit the Baltic mixed with the marine, or I shall begin to think that that sea of old was more salt than now.' Accordingly I found for the first time at Bränkyrka all the marine shells before met with, and in addition, the *Neritina* and *Lymnea* I had been *wanting*. I so wished you had been there. Both the Colonel and Johnson entered with spirit into the search (seventy feet above the sea), and wondered, when the shells turned out, which I had complained of missing elsewhere. 10 P.M.—I have been with Colonel Blom, walking in the 'deer park,' and seeing the site of an intended royal museum for works of art, to be built after Blom's plans. Berzelius had been requested by the King to see if the marble was good. I suppose he had spoken of me, for when we talked, said Blom, of rapid travelling, the King said, 'There is an English gentleman here inquiring at what rate the sea is being turned into land;' and when Blom said he knew me, the King said, 'You may learn then from him how soon England will be joined to Sweden, and when we may think of a railroad communication.'

Johnson has just told me a capital anecdote to illustrate the superstition of the Scanian peasants. A lady he knew asked one of them whether he would answer for a horse, he wished to sell her, being not apt to take fright. 'That I can,' said the peasant. 'He stood for three weeks in my

stable, night and day, *alone*, and I never could see that he showed the slightest symptoms of fear.'

Marklin sent the fossils, such as he had time to pack up, as he had promised, to Stockholm. He diverted me much by his originality, and among other things, when lamenting at Gamla Upsala that the wood had been so cut down, young and old all cleared away, he remonstrated with a peasant that they would soon feel it. 'Not in our time,' was the reply, 'those woods are so near.' 'Well,' said Marklin, 'it may be you will not in your time *here*, but have you not heard that there is another place where the wood will warm you—when every tree wastefully cut down in this world is to be burnt over again, for the punishment of those who felled it?'

July 12.—We came by Södertelje, Arboga, Orebro, and are now within a stage of Marienstad, through a fine sunny country, where they are carrying hay, which smells very sweet, and where the rye and wheat have already a yellow, autumnal colour. So much of Sweden is of granite and gneiss blocks uncovered with any soil, that it must always remain mere forest land, and the trees have no small difficulty in growing, by finding a small rent in the rocks. At one place I remonstrated against a horse who had a wound in the leg. The ostler said a wolf had bit it, and had not the other horses in the field come up to his rescue, he would have been devoured by the wolves. When I asked the other evening why they blow a horn in the woods at night, the answer was, for the wolves. They will not come near the cattle when they know that the herdsman is awake. This horn, which I have heard often, sounds savage, and like an alarm for an enemy.

Marienstad: 13.—This town is finely situated on that inland freshwater sea Mälar, and good-sized vessels, such as can pass the Trollhätten canal, are here. The dry weather has made one of the wheels in a bad way, and we are consulting with a blacksmith about a repair. It is a fortnight or more since any repair has been called for. We met to-day the diligence from Stockholm to Gotheborg, the first public conveyance of any sort I have yet seen on any road in this country.

Lidköping: 14.—I have had a grand day on Kinnekulli, a mountain which rises nobly on the shores of Lake Wener, to the height of 800 feet above the level of that lake, composed at the summit of volcanic rock or greenstone, and below of perfectly horizontal shale and limestone, in which are trilobites, orthoceri, &c. I worked hard, and got a pretty good harvest. After I wrote to you at Marienstad, we were overtaken by the first heavy rain we have had in Sweden, and arrived very wet, at least some of the things, at a wretched poor cottage, the post-house at Forhsäm, where nevertheless I slept sound and unbitten. But to-day we have had splendid weather, and a view I should have liked you to see. We could have got on farther to-day, but at this place were told we must wait three hours for horses, so I resolved to go to bed very early, and be off at four o'clock to-morrow morning. It is quite amusing to see how splendid the maypoles are here, with flower garlands, and egg-shells blown and gilded, round a tall fir-tree pole.

15.—Went to see some mountains near Wenersborg, called Hunneberg and Halleberg. Saw a place, a great precipice, where *dévots* of old threw themselves down, in order to go to heaven to Odin. There is a pond below where the corpses were washed, and urns are dug up, in which the ashes of the burnt bodies were buried. These places are called 'ättestupa.' The place is in a defile between the mountains before mentioned and very romantic scenery. I then saw the Falls of Trollhätten, with which I was altogether disappointed. Mere rapids, a succession of them to be sure. The canal and locks are well worth seeing. I was very glad to get safe over the ferry of the Gotha Elf, as one of the horses liked the look of the rift as little as I did.

Gotheborg: 20.—Arrived very late last night. This tour has answered far beyond my expectations. Uddevalla was a great treat, a perfect Dammerie[3] of the recent period. The boating to the isles of Orost and Gullholmen, and afterwards farther south to Marstrand, also enabled me to do much geology, and ascertain about the levels, which I think will be valued by the Royal Society. Shells I saw and collected, and I think understood, in the same places. Four of the

[3] A noted place for the tertiary shells of the Paris Basin.

most energetically spent days I ever remember, a trial for the carriage, and for Johnson's power of exertion. Both stood it very tolerably, better than could be expected. I am surprisingly browned and disfigured with my week's work and boating, &c., but am thankful that without an accident, or day's ill health, I have accomplished my objects.

July 21.—Got your letter of the 1st of this month the moment the post office opened this morning. Last night found the shore of the river covered with *Strombus pes-pelicani*, a *Donax*, *Cardium edule*, *Mytilus* do., a *Tellina*, a *Cardita*, &c., recent species. Tasted the water, quite fresh; but it *was* salt, as the shells speak to that. Asked Vice-Consul Harrison, and was told that the sea is always retiring.

Cornubio Steam Packet: July 22.—The timbers tremble, so that I must write a shaking hand. Off the low sandy coast of Jutland. The steamer too much loaded with Swedish iron to sail well, but wind quite in our favour. To return to my tour, I found Uddevalla an agreeable, picturesque place, and accommodation good, because people come there to some hot springs in the neighbourhood. Hired a coachman and horses to drive us about to the places where the shells occur, and got some of the barnacles attached to the solid rock of gneiss, and some other shells of which you must tell me the genus. The next morning travelled south to a ferry, which took us to the island of Orost, which is made of mica-schist, much barren rock, with heather here and there, and great mosses, and the soil of the Balentore part of Catlaw.[1] The islanders very active and obliging. The pilot dead who had made the mark at Gullholmen: unlucky. His widow petitioned me to get Col. Lunstedt to get her the pension she was promised. Visited rocks which had emerged in her lifetime. Hired the services of a smith to make a mark at the water's edge: C. 18. L. / 18. 7. 34.

July 24.—We have been getting on, with a good wind, eight miles an hour, and are within one hundred miles now of Hull.

Edinburgh: 27.—I have got my place outside of the

[1] The Grampian hill near Kinnordy.

Defiance coach, so I hope it will not rain. I shall put this in at once. Send to Glammis.

Your affectionate husband,

CHARLES LYELL.

CORRESPONDENCE.

To G. MANTELL, ESQ.

16 Hart Street, London: October 1, 1834.

My dear Mantell,—I am here again, returned with my wife a few days ago from the Edinburgh meeting, which went off in my opinion very well. After my return from Sweden I passed some weeks at my father's, in Forfarshire, where among other visitors, during my father's absence in Paris, I had to entertain Robert Brown, the botanist, for several days, who was good company, and had lately returned from a short excursion with Fitton in Portland, where he had collected the 'cycas,' as he now admits we may call it, for he has discovered new points of identity in its structure with the modern cycas. In Sweden I satisfied myself that both on the Baltic and Ocean side, part of that country is really undergoing a gradual and insensibly slow rise. A sketch of my observations which I gave in Edinburgh to the geological section is already printed by Jamieson, and the detailed paper on the subject I mean to read to the Royal Society. When in Edinburgh, I promised to accompany Agassiz to Brighton to see your collection, and I expect him here in a week; but he will be here some ten days, I suppose, before leaving for you. He has found about a hundred new species of English ichthyolites, making seven hundred fossils in all. He made out that *all* the supposed saurians of the carboniferous period of Scotland were only sauroidal *fish*, and that Hibbert was so far out, but they were very curious and new forms of fish. His readiness and knowledge are surprising, and you will find him very skilful in reptiles, though he does not profess to know anything about them, except that he maintains he can prove the pterodactyls to have been swimming, and not flying, animals! I have been sketching and making some progress in a single volume

which two years ago I promised Murray, a purely elementary work for beginners on Geology, and which I find more agreeable work than I expected.

I have begun fossil ichthyology, and am attending Daniell's lectures on chemistry, so I have enough to do.

Believe me, ever faithfully yours,

CHARLES LYELL.

To G. MANTELL, ESQ.

16 Hart Street: December 10, 1834.

My dear Mantell,—I ought to thank you for the warmth of your congratulations on my receiving the R. S. medal, which was sent me through my sisters, and assure you that the pleasure they received from it was doubled by having you to talk it over with, and witnessing your *ecstasies* at the news. You will be glad to hear that Greenough, who presided at the Geological Committee of the G. S., obtained by letter the suffrages of many absent geologists, how many I know not; but a letter of Fitton's which was read by him to the Council had no small influence, and assisted in overruling G.'s own doubts, which were strong on theoretical grounds.

The medal was given me distinctly for 'the Principles,' not for my paper on Sweden, which is half read, the remainder to be heard on Thursday, 18th.

Sedgwick's prebendal stall is seven hundred a year, two months' residence, and he is now giving occasional sermons in the Cathedral at Norwich, and very popular with the Dean, whom I saw the other day.

Ever sincerely yours,

CHARLES LYELL.

CHAPTER XIX.

JANUARY–DECEMBER 1835.

BUCKLAND'S BRIDGEWATER TREATISE—CRAG SHELLS OF SUFFOLK—PARIS—VON BUCH—BERZELIUS—GEOLOGY OF SWITZERLAND—MEETING OF NATURALISTS AT BONN—AGASSIZ CATASTROPHE SYSTEM—HIS LOVE OF NATURAL HISTORY—DESHAYES' ZEAL FOR CONCHOLOGY.

[He was elected President of the Geological Society in February 1835, and in the course of this year he made a tour by the Jura into Switzerland, returning by Bonn on the Rhine, where the German Naturalists' Association met.

In the summer of 1836 he went to Edinburgh and Kinnordy.]

CORRESPONDENCE.

To Rev. Dr. Fleming, Professor of Natural Philosophy, King's College, Aberdeen.

16 Hart Street, Bloomsbury, London: January 7, 1835.

My dear Dr. Fleming,—I was made truly happy by again receiving a letter from you, for I had been disappointed at not seeing you at the Edinburgh meeting, where your name not only occurred in print, but some were ready to declare they had seen you in town. Sedgwick, in one of the animated discussions in the geological section, happened incidentally to come upon you, and in his rapid extemporising way said, 'Dr. F., a tough antagonist to deal with, and with whom I never yet had to do in this, or other matters of controversy, without getting the worst of it;' or some words to that effect. I think we were upon the fish scales in Old Red. There was something droll as well as candid in what fell from him, which made us all laugh at the time, and yet, when I wanted afterwards to recall it, I could neither get from Buckland nor anyone else the precise point or expressions.

There was so much done in debate, that one may be excused for being a bad reporter. The sections answered well. The evenings badly—too much display to suit with my notions of what philosophers should do. The platform always reminded me of the hustings, on which a set of political speakers were holding forth to ladies and gentlemen, and this I think was a pretty general feeling. I am using my wife's hand in penning this part of my epistle, for my eyes, which, you remember, were never of the strongest, although now behaving better than formerly, have been rather fatigued this week, by having candles in the daytime during the fog, and I have to read as Secretary at the G. S. to-night, Hamilton having gone to canvass the Tory voters of the borough of Newport. As you said nothing in your letter of Mrs. Fleming, I must beg you to write soon again, and give me some domestic news. We are quite well, and thinking of going to Paris and Switzerland next year. I am writing an elementary book on Geology, and wish I may disappoint my friends, who all agree that I shall make it too deep. It is to be the size of one of my four volumes of the third edition. I have been reading Dr. Boase's work on Primary Geology, an attack upon the Plutonic theory by one who was never out of Cornwall, and who seems to make light of all but Cornish observers. It is good, however, to read what an antagonist has to say, who has worked hard at Cornish granitic and mineral veins. You should read it when you have time to take in hand the granite veins near Aberdeen, which Dr. Knight took me to see. Pray make drawings of them when you can, and anything which makes for or against my hypogene and metamorphic views, or heresies, as I suppose Boase would have it. I also wish you much to send a paper to be read at the G. S. here, on the *great Flisk dike*. I never saw a more splendid case of the passage from the granitiform to the trappean mixtures. Don't ask me to define what I mean by these terms. De la Bêche's last book, called 'Theoretical Researches in Geology,' is by far the best thing he has written, but in his statement of the question as to the origin of the crystalline or primary schists, he suppresses or blinks the numerous facts of altered fossiliferous strata in a sub-crystalline, or, as Werner would call it, transition state.

The key to their origin ought, I think, to be sought in such passages. I mean to go to Glaris this year, the slate of which, looking like primary roofing slate, contains, according to Agassiz, chalk fish. It has been said sneeringly that fossils may prove that black is white, and white black, but I have no objection to these black slates having once been mud of the chalk epoch. Buckland's Bridgewater Treatise is only promised to us at Easter. We are curious to know what he will do about his diluvial theory, and if I hear true he has more than once changed his plan. He told me, however, that his mode of reconciling Geology and Genesis in his B. Treatise had been approved of by the Oxford Professors of Divinity and Hebrew! Mantell, whom I visited lately at Brighton, has made a bold professional stroke in removing there, which you will be glad to hear is likely to succeed, in spite of the misgivings of many of his friends, who had not the confidence which I always had in his genius. He is, in fact, a man of great medical skill, and tact so great, as to triumph over the drawback of his having so fine a museum and so much fame in certain branches of geology. You will rejoice to hear of an anatomical triumph which he lately obtained.

Amongst the very numerous species of large saurians found in the Wealden beds, there were many bones without owners, some of which he claimed for his Iguanodon, rejecting others, and on several points Buckland presumed to take the opposite side. A large block of limestone was lately found, in which a great number of bones were together, accompanied by the tooth of the Iguanodon. They consisted exclusively of those which he had referred to that animal, vertebræ, femur, &c., and not one of those which he had refused to admit as belonging to it. The position of these bones is geologically very singular. They occur above the freshwater beds of the Wealden in the inferior part of the Lower Green Sand, thus connecting the fossils of the Wealden and cretaceous groups.

I hope you will see Mr. Horner when he is next in Aberdeen. With my kindest remembrances to your family, believe me ever most truly yours,

CHARLES LYELL.

To G. MANTELL, ESQ.

February 1835.

My dear Mantell,—The dinner[1] went off famously, more than a hundred present. After the toasts had been given of the King, Royal Family, Geological Society, late President, and President, I gave you. I send you a copy of my speech almost word for word as delivered, and on looking over my notes, I found I had not omitted any of the material points which I had intended to speak of. I assure you I had the feeling of the meeting with me, and in some respects it produced a better effect than if you had been there. It was by far the longest toast given, but I am sure they were not tired. Lord Lansdowne, who was on my left hand, asked all about you. I got him to give Oxford and Buckland. Fitton gave Cambridge, answered by Sedgwick; Sedgwick the Royal Society, answered by Lubbock; Buckland the Linnæan; I, the Astronomical, answered by Baily; Greenough the Geographical, answered by Murchison. We then drank Burnes, the traveller, who made a good speech. Warburton also held forth as Vice-President, and I wound up by an eulogium on Lonsdale, which I did *con amore*, and it was received with enthusiasm. We adjourned late to hear Greenough's address, a matter-of-fact abstract of the proceedings of last year. On my right hand at the dinner I had the Belgian minister, Van de Weyer. Among others, there were Hallam, Stokes, Lord Cole, Sir Charles Lemon, Duncan of Oxford, Sir A. Crichton, Ingham, M.P., Drinkwater, &c. &c.

I received a paper in the morning from Greenough containing the award in your favour, as also a new 20*l.* note and two sovereigns. I cannot tell you how soon the medal, which is of the value of ten guineas, will be ready.

Believe me, ever most truly yours,

CHARLES LYELL.

To G. MANTELL, ESQ.

April 13, 1835.

My dear Mantell,—I have been getting Dinkel to figure for me some fossil eggs of a turtle, found in the island of

[1] Anniversary dinner at the Geological Society, when the Wollaston medal was awarded to Mr. Mantell.

Ascension, imbedded in a hard rock something like that of Guadaloupe which contains the human skeleton. It is clear that the eggs were nearly hatched at the time when they perished, for the bones of the young turtle are seen in the interior with their shape fully developed, the interstices between the bones being filled with grains of sand, which are cemented together, so that when the egg-shells are removed perfect casts of their forms remain in stone. On my showing the specimen containing seven eggs to Owen, of the College of Surgeons, he remarked to me that they were hollow, whereas the bones of reptiles want the medullary cavity. Struck with this remark, and with the extreme hollowness of the bones, only to be compared to that of some Tilgate specimens which you have often shown me, I got Owen this morning to dissect for me a young turtle, not a fœtus, but so young that the mark of the attachment of the yolk was still a large opening. He immediately showed me that the bones were not hollow, though we both remarked that the outside looked harder than the interior. After we had discussed the matter for about a quarter of an hour, we found, to our great surprise, that the matter in the interior of a small humerus, clavicle, scapular, and coracoid, which had been taken out, had dried up and become as hollow as the fossils, or as some of your supposed birds' bones, which may perhaps be the fœtal bones of gigantic turtles, for the dried bones which I have saved for you are more empty than those of birds; and when the ball-joint of the humerus shrunk away to nothing, on the evaporation of the spirits of wine, it was marvellous to see how a bone, previously so dissimilar in form, became the facsimile of one of my small fossil humeri. Owen has promised to get me a set of very young turtle's bones from the Zoological Gardens, and I am persuaded it will clear up a number of your difficulties.

Believe me, ever most truly yours,

CHARLES LYELL.

To Sir John Herschel.

16 Hart Street, Bloomsbury: July 6, 1835.

My dear Sir,—I heard some months ago from Whewell that you had, in one of your letters to him, expressed much pleasure at some parts of my book, which I think you read when on your way to the Cape. It has been so much altered, enlarged, illustrated, abridged, and I hope improved since the first edition, that I am anxious, if you ever refer to it again, that you should see it in its amended state. Some of my friends have read letters of yours which they had received, to me, and I rejoice to find that your grand scheme of visiting the Southern Hemisphere has answered so well.

When at Copenhagen last year Oersted, who was reading your paper on double stars, was talking of it continually, and trying to make me understand the *poetry* of some speculations, which only amused me, from seeing that it was deep mathematics with which he was delighted, as with a romance.

Murray has sold 1,750 copies of my book in the last ten months, so that I have the satisfaction of being much read. You will see by my paper in the Royal Society Transactions, and by a new chapter in Book IV. last edition, that I have recanted about Sweden.[2]

Hoping to have one day the pleasure of seeing you again in England, and that before two years have passed away,

Believe me, ever most truly yours,

Charles Lyell.

P.S.—Some chapters in your astronomy, on the theory of the earth's motion, for example, and on parallax, appear to me very successful, in the object of making such subjects intelligible to persons ignorant of mathematics.

[2] In early editions of the *Principles*, he expressed his doubts as to the validity of the proofs of a gradual rise of land in Sweden, while his visit to that country in the summer of 1834 convinced him that the evidence adduced in favour of the change of level was full and satisfactory.—See fourth edition of *Principles*.

To the Rev. Adam Sedgwick.

Paris: July 23, 1835.

My dear Sedgwick,—I hope you will receive this when you are at the meeting at Dublin, and shall be obliged to you if you would give me some account of the manner in which it went off, and send your letter to Poste Restante, Bonn.

We shall get to Bonn by September 18. Many thanks for the letter of friendly counsel which I received from you just before I left London, and by which I profited.

I forget whether you were with us in June last, when the question of the age of the crag was discussed, but you have probably heard that a great number of very perfect shells have been procured from a lower bed of the crag in Suffolk, and it was supposed that this bed which Mr. Charlesworth called the Coralline Crag, might belong to an older Tertiary period than the upper or red shelly crag. Phillips leaned to the opinion that the proportion of recent to fossil shells would not turn out to be so large as that which was deduced from the first collection of crag shells which I brought some years ago to Paris. Buckland also dwelt on the fact that all the fish of the crag which Agassiz had seen were extinct species. I wrote in vain to Mr. Wood of Suffolk, who it seems was travelling for his health, to try and get information from him, as he is said to have collected 400 crag shells; but I brought with me to Paris more than sixty species of shells, in excellent preservation, all collected by Mr. Charlesworth from the Coralline Crag, some abundant, others rare, in short a fair sample, and have had them carefully examined by Deshayes, and have compared them all myself, with shells in his collection. The result is that the proportion of recent shells (almost all inhabitants of the British or Norway seas) is actually greater than that obtained from the first set which I took to Paris, in short the proportion of these is actually more than 40 per cent. On the other hand, the extinct species are not Miocene, or those of the Faluns of Touraine or scarcely any of them. I think we may lay it down as a rule, that if in any given tertiary

deposit, in which we have found a few species of shells only, of which half or a third, or even less are recent, and those recent ones inhabit the seas immediately adjoining, the formation will be Pliocene, whereas the recent shells of the Miocene strata have a more exotic and tropical form. I have been rather diffuse on this point, because I think some of our friends will be interested about it at Dublin. I should add that I have not yet had the corals examined, which at first sight look more like the Touraine fossils than the shells do.

I found here Von Buch, E. de Beaumont, Dufresnoy, Constant Prévost, Virlet, Boué, Alex. Brogniart, and have had much talk with all of them, and some warm discussions with Von Buch and de Beaumont. Of the first, I must say that I find much to like in him. As I had handled some of his opinions very roughly, and as he is too much accustomed perhaps to have unbounded deference paid to them by most of his own countrymen, and by no one more so than by E. de Beaumont, I had no right to expect a very cordial reception, but he met me with great frankness, and at once set me at ease by vehemently protesting against my numerous and crying heresies, none of which, not even the elevation crater theory, seems to have excited so much honest indignation as my recent attempt to convey some of the huge Scandinavian blocks to their present destination by means of ice. If you read my Swedish paper, which I sent you, you will remember that I proved that some of the huge Swedish blocks near Upsala must have travelled to their present destination, since the Baltic was a brackish water sea, so that those who maintain that there was one, and one only rush of water, which scattered all the blocks of Sweden, and the Alps, must make out this catastrophe to be as it were an affair of yesterday. As to the elevation crater business, Von Buch, de Beaumont, and Dufresnoy, are to write and prove that Somma and Etna are elevation craters, and Von Buch himself has just gone to Auvergne to prove that Mont Dore is one also.

Prévost's sketches of Vesuvius and the Lipari volcanoes are excellent, and some of his objections to Von Buch's theory which I had not made are unanswerable. I will give

you one. In Mont Dore and Cantal there is a vast thickness of volcanic matter in the centre, which thins off on all sides towards the base of the cone, so that the granitic rocks crop out in the one case, the fresh water in the other. So in Etna do the marine strata; and in Palma the volcanic mass is thinnest round the outer margin or base of the island. But if these masses had been upheaved by elevation, it would be in the centre, not towards the circumference that the fundamental rocks would rather be seen, and the volcanic mass would not be thinner towards the middle. As to marine shells found on the slope of Vesuvius, it is no argument, for there must be many on the slope of Stromboli. Prévost made a drawing of the four dikes which I saw in the modern cone of Vesuvius, dikes resembling those of Somma, which are numerous in Stromboli, Etna, Mont Dore, and other volcanoes, near the great craters of eruption, and are comparatively rare in volcanic masses far from those centres. I much regret that so undescriptive and as I think theoretically false a name, as elevation crater, is to be given by all Von Buch's school to every dome-shaped elevation. In the latter, as in the Wealden and others, the oldest rocks are seen in the middle, while it is just the reverse in Mont Dore, Cantal, Etna, and other volcanoes.

July 23.—To-day I have seen Van Breda of Leyden, and after him no less a person than Berzelius, just come from the North, and to the same hotel in which we are. He gave me a warm and hearty greeting, in the German more than in the French style. I have not had time to hear news from him. The map of France is now all but finished, and looks very handsome. To me who know more of French than of English geology it has the effect of a beautiful picture, and the great granitic boss of Auvergne, &c., forms a grand central feature, without which there would be a want of unity, as compared to our map. I am reading you and Murchison on the Eastern Alps, as I am going so near your section. Your elaborate joint paper is now quite a treat. Boué has given me many Gosau fossils. He is going to live four years in Vienna, and next year to do the Balkan. My wife says, 'Give my kind regards to Mr. Sedgwick, and tell him it is dreadfully hot.'

Remember me to Murchison and all friends, and hoping to hear from you, believe me, ever most sincerely yours,

CHARLES LYELL.

To VISCOUNT COLE.

Meyringen: September 6, 1835.

My dear Lord Cole,[3]—I promised to write to you after I had been at Glaris, but as it will now be impossible for me to go there, I shall still let you hear of my proceedings and explain my change of plans, assuring you that I am determined at no distant period to profit by the instructions which you and Egerton gave me. As my eyes are not strong enough to allow me to write much by candle-light, I shall beg my wife to write a little, while I dictate.

I set off for Berne by Vésoul and Porrentrui, having a good work at the latter place with Thurmann, who has a collection which you should see, if ever you pass that way, as also that of M. Thirria at Vésoul. I made an excursion also to Neuchâtel, and got some fossils there of which I daresay Agassiz may have given you some duplicates. I made an excursion there into the Jura with M.M. de Montmollin and Coulon, both of whom have collected many fossils from the Neuchâtel chalk. After having examined the museum at Berne with Studer, I set off to the mouth of your old friend the Kander, determined that I would not be outfathomed by the lake, as you were. I took a line about five hundred feet long, and carried out my soundings in two directions from the edge of the delta. I have not had time yet to calculate the results of these observations, but I believe the slope of the new deposit under water is not so steep as we made out from the soundings which you and Egerton made. When I was thus far on my way, I had everything prepared for the Glaris campaign, having always meant to take the Jungfrau where the gneiss overlies the limestone with oolite fossils in my way, as also the Urbach Thal near this place, where similar things were to be seen. But I found when I attempted to understand the geology of the neighbourhood

[3] The present Earl of Enniskillen.

of the lake of Thun, even with Studer's newly published book and map and sections as he calls them in my hand, that I could not at all comprehend it, nor make out what he meant by his numerous formations. I therefore determined to make myself master if possible of the geology of this part of Switzerland, on which much more has been now written than on any other part of the Alps, before I made an attack upon less known districts. This I have in some measure accomplished; but in doing it and climbing the Jungfrau and the Urbach Sattel, I have spent the time which was to have been given to Glaris, which I hope, however, is only postponed. I must now proceed at once on my way to the Bonn meeting. I have just come down from a châlet at the southern foot of the Stellihorn in the Urbach Thal, where at the height of nine thousand feet I found ammonites, and got some more from a chamois hunter at whose châlet I slept. I daresay you know that the Swiss Alps have a bad name for fossils, so you must not expect to see me return with many. This morning I got what I suppose to be a Pentacrinite at Brienz, which I bought from a boatman, and I suppose they might get other things if they did not waste all their time in hunting for quartz crystals. I long to hear how the Dublin meeting went off, for I have not seen a word about it in any paper. Indeed I have only got sight of newspapers about once in a week or ten days, just enough to see that the everlasting Parliament was still sitting, till after the Association met at Dublin, which I am afraid must have interfered with the attendance of some good men. I cannot sufficiently congratulate myself that I am not in such a position as to make it a duty to take an active part in politics in such times, but that I can ride my hobby during the whole summer, without fearing either a call of the House or the hustings to stop me short. I took your hint, and instead of Interlachen went to Unterseen, where I stayed several days and found the charges very reasonable. I hope still I shall get some 'birds' tongues'[4] at Utmarsingen. I saw some of them in the Berne museum, or at least from that neighbourhood. I expect to be back again in town before the end of September, and shall have a pretty good load of rocks to

[4] A local name for the palatal teeth of certain fossil fishes.

take back, though I shall not have much to boast of in the way of organic remains. By-the-bye, I got a new light this morning, touching these remains. The waiter here assured me that it was only in stones that had been for a long time in the foundations of houses that such figures of shells and other things were produced, so that unless one had the luck to be passing when an old house was being pulled down, there was no chance of getting anything.

I must now conclude, as to-morrow I must be off early with horses to cross the Brunig. Mrs. Lyell desires her remembrances, and

Believe me, ever most truly yours,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

London : October 14, 1835.

My dear Mantell,—I made out the greater part of the tour which I had planned most successfully, first visiting Paris, where I found Von Buch, whom I had never met before, and whom I liked well, notwithstanding my opposition to many of his opinions, and although there are few persons who are more noted than he is in geology, for conceiving a personal hostility towards those who do not embrace the theoretical doctrines which he has once published. I took a collection of crag fossils from those lowest beds, which have been lately called the Coralline Crag, and they were carefully named by Deshayes, and compared with his usual patience with the fossils in his rich collection. It was a delightful lesson in conchology for me, and the result was that half of them were recent species, contrary to the anticipation of some of the worthies who had collected them or talked about them at our G. S. I entered Switzerland by Porrentrui, and there I had Thurmann for my guide, who gave me in a short time a beautiful insight into the structure of the Jura, on which he has published, and I was glad to verify his observations in the field, and to see his beautiful collection of Jurassic shells, and his attempt to assimilate the oolitic series and their fossils of the Swiss Jura with our English oolitic groups. I afterwards had a work in another

part of the Jura with some geologists at Neuchâtel, where the chalk, as it appears to be by its fossils, fills the bottom of the valleys of the Jura limestone. I next had a work with Studer at Berne, and then had a work of about six weeks in that part of the Swiss Alps which is called the Bernese Oberland. I there saw alternations of the gneiss with limestone of the liás or something newer in the highest regions of the Alps, of which I shall give the Society an account during the next season. I also endeavoured to make out the order and age of the strata between the central granitic axis of the Alps and the great tertiary valley of Switzerland, in other words, the country around the lake of Thun and between the town of Thun and the Jungfrau. We then came down the Rhine to Bonn, and spent a week there during the meeting of the German Association, which was about six hundred strong. They elected four presidents for the geological section, Von Buch, Buckland, de Beaumont, and myself, and we presided in turn. For two whole days Constant Prévost and I fought Von Buch and de Beaumont on the craters of elevation, the discussion being in French, and with a crowded audience. I am as convinced as ever that their views are quite erroneous, and if I had to write over again to-morrow my chapter on that subject, I should have nothing to retract and many new arguments to add. We had Greenough there, and Omalius d'Halloy, Goldfuss, Count Mandelslohe, and Professor Walckner, Von Meyer, Alexander Brongniart, Adolphe Brongniart, Andouin, Berzelius, Schmerling of Liege, Hoeminghaus, Von Oeynhausen, Noeggerath. I mention some of those who first come to my recollection as having attended our section. On my return here I found that in spite of Lonsdale's exertions and Fitton's pledge to the Council, that his paper should be concluded in July, there is still many a green grain of sand yet to fall through the hour-glass. People seem to be in high spirits here on the success of the Dublin meeting. Agassiz looks in good health, and is satisfied with the great progress he has made, and looks forward with great pleasure to a first visit to Brighton. When I call, I find him sitting in his room with his two horse power, for he has had the spirit to get over a second German artist. I have been writing this by candle-

light, after the labours of the day, and as you know my eyes of old, you will excuse its not being in my own handwriting. After all our wanderings we hope to be stationary here for the next nine months, and shall be always delighted to see you here, even for one of your flying visits, and my wife unites with me in kind regards,

Believe me, my dear Mantell, yours most sincerely,

CHARLES LYELL.

To PROFESSOR SEDGWICK.

London: October 25, 1835.

My dear Sedgwick,—I was very glad to hear your account of the Dublin festivities, which, like those of Bonn, were I suspect rather overdone in the way of dinners. I am persuaded that such meetings and displays of strength, and numbers, and convivialities, do much good, but really they are no small sacrifice to the real good and true workers in science, out of their summer's vacation, and when they have thought that they escaped from a bout of spring dissipation in London till the year following. This I felt on the Rhine, and should have done so at Florence-Court, though much good was done to our friend Lord Cole, who tells me that his father has been in great good humour ever since he had the satisfaction 'of seeing Murchison and some other guest *glorious*, and Sedgwick *comfortable*.' Depend upon it the building of the museum, and subsidies for what the old Lord once condemned as 'damned nonsense,' will go on with good spirit, after his finding that the hammer-bearers are such a jolly set. I had heard nothing about Agassiz' catastrophe system at Dublin, but no sooner did I try to get him upon fish when I met him here, than he let off upon me, and I was obliged to compromise half our time day after day most unprofitably in arguing with him. This I did the more zealously from his telling me that he was going to give some lectures on geology at Neufchâtel. He does not flinch at trifles, for finding that the whole cretaceous system from the bottom up to the Maestricht beds has the same fish (so he declares), he deposits the whole during one commotion of the sea. I am in hopes, however, that I have made some impression on him. His knowledge of natural history surprises me the more I know of him, and he has that love of impart-

ing it, and that power of doing it with clearness, which makes one feel one is getting on, and that one has caught his enthusiasm. I feel this also strongly when in company with Deshayes, who continues steadily to cultivate his own branch, and that under somewhat discouraging circumstances, both pecuniary, and from being in an atmosphere where there are not many kindred spirits, who would continue devoted to their science for its own sake (as I am sure he would), and not as a means of living. In this respect he would be better off in Germany or England, or even in some of the provinces of France. I assure you that his examination of the 80 species of Crag shells was most conscientious, and I went into it thoroughly, and we had no idea, till we summed up at the end, what result we were coming to. As to Phillips doubting the identifications, recollect that many of these Crag species are the same as some brought from the North Cape and other parts of the northern ocean. They have not yet been described nor named, and whether Mr. Bean of Scarborough happens to have found them on the British coast or not, or whether they are in York Museum, is immaterial.

It requires a vast series of varieties to make out these identifications, and mark, the same method leads to consistent results, for Deshayes would agree with Phillips & Co., that scarcely any of the Eocene shells are recent, that the living shells of the French and English coasts agree in great part, while those of India and the Mediterranean differ. As to the fish of the Crag being extinct, I suspect that Phillips would admit with Lonsdale that Strickland's 25 or 30 species of freshwater shells were recent British ones, except perhaps one or two; and yet they occurred with an extinct hippopotamus, rhinoceros, &c. The vertebrate must have fluctuated more rapidly than the testacea, and if this be true of the first step, or newer Pliocene, is it not more consistent that it should hold on? Before I have done with Deshayes, let me remark that the School of Mines did homage to his knowledge lately, by offering him a sum of money to name their shells. It cost them no small effort, but there was no man in office, no successor to Lamarck's or any other chair, who could do the work for them. Deshayes declined, for he was deeply engaged with the booksellers. I tried to persuade

him to come over to England, but it is impossible. Having begun without a farthing, and having dared to cut medicine entirely, he must work hard the whole year to preserve his independence. With all his faults, I am persuaded he might have got on, and might now if he would condescend to be more of a courtier, for court is too much exacted in Paris by those who have the good things to give away.

As it is my wish to propose the Wollaston medal this year to Deshayes, I wish you would have a talk with Agassiz when he is with you about the matter, for I believe there is no one in London who has seen so much of Deshayes, and knows so well his acquirements and the difficulties he has overcome as Agassiz. I am sure that if we could draw Deshayes over here, he would make a grand reform in our Museums, like Agassiz, and that he would discover rich mines of hidden treasure.

Did you see that Captain Fitzroy had borne witness in a court-martial that the late Chilian earthquake had altered the whole coast? that a north-westerly had become a southerly current? that the island of Mocha was *upheaved* 10 feet? and this upon *oath*! and the captain of the 'Challenger' acquitted on this evidence! Give me but a *few* thousand centuries, and I will get contorted and fractured beds above water in Chili, horizontal ones in Sweden, &c. I have got from Denmark a notice by Dr. Pingel, on the gradual *subsidence* of Greenland. As to erratic blocks, I have no positive general theory, but after seeing Sweden, I cannot for a moment believe they are due to diluvial action. I saw none in Italy, Spain, or Sicily, a few in the Jura and Alps, hundreds in Denmark, thousands everywhere in Sweden, and of stupendous size. It seems to me *a northern* phenomenon when best developed. Ice does annually carry large stones on Lake Wener, and in the Gulf of Bothnia, not so big as cathedrals I grant, but tolerable sized pebbles, such as many men could not move.

But I must return to this when we meet, only remember that icebergs float now much farther south than the Jura. I have no room left for my Alpine observations, but hope to give you a paper on them at G. S. Write when you can, or *come here*, and believe me ever yours,

CHARLES LYELL.

To PROFESSOR SEDGWICK.

London: December 6, 1835.

My dear Sedgwick.—I have been drawing up a summary of your short but pithy paper on slaty cleavage, and trying how far I could reconcile what I saw this year in some slate rocks in the Alps with your general rules, which in some respects I find difficult enough, in as much as I found the cleavage or slaty structure of fine drawing slate in the great quarry of the Niesen, on the east side of the lake of Thun, quite coincided with the dip of the strata ascertained by alternate beds of grey wacké. Now Murchison tells me, to whom I showed specimens of this slate, that you would call its cleavage 'the fine flaggy.' But as it is the best description of drawing slate, and as divisible almost as mica into thin plates, I cannot make out how to distinguish such a structure from any which can be called slaty, and such an attempt would I fear involve the subject in great confusion.

At the last meeting, Cuming's paper was read, denying that in 1822 there was an elevation of the land at Valparaiso. Greenough had been very anxious that this should come out. I had already given an abstract of Cuming's evidence in my 4th edition. It is clear and curious, and although it probably proves, as Basil Hall observed to me last year, Cuming's want of optics, it is still worth recording, as his attention was called to the fact of elevation by Mr. Graham's paper, and he swears that he looked for the phenomena, and found none. I believe Mr. Graham, my friend Cruikshanks, and others *contra*, but it is a blessed thing in this world of scepticism, that thirteen years only should have passed away, before another and greater upheaving took place, authenticated by Fitzroy, whose papers, which have not yet reached the Admiralty, I am anxiously expecting. I remarked at the last meeting, that if the notion of the rise in 1822 had been as purely imaginary as Cuming, Woodbine Parish, and Greenough pretend, that the chances were almost infinite against nature's having performed a similar operation soon afterwards on the very same coast as if expressly to give credibility to the previous notion. How I long for the

return of Darwin! I hope you do not mean to monopolise him at Cambridge.

My wife joins in kind remembrances, and is curious to know whether her cousin Elizabeth Winthrop, sister of Mrs. Edward Pellew of Yarmouth, was able to come to the deanery to hear your lectures. If you see her, you will certainly fall in love with her.

Believe me ever, most truly yours,

CHARLES LYELL.

CHAPTER XX.

FEBRUARY–DECEMBER 1836.

ON MONEY FOR MUSEUMS BEING FRITTERED AWAY IN BUILDINGS—LETTER TO SIR JOHN HERSCHEL ON THE ORIGINATION OF NEW SPECIES—KINNORDY—DR. FLEMING APPOINTED PROFESSOR IN ABERDEEN—DR. FITTON DECLINES PRESIDENTSHIP OF THE GEOLOGICAL SOCIETY—LETTER TO DARWIN AGAINST HIS UNDERTAKING OFFICIAL WORK.

CORRESPONDENCE.

To G. Mantell, Esq.

February 10, 1836.

My dear Mantell,—I shall of course mention your Tilgate birds with due honour, but as I have written my speech exclusively on the proceedings of last year, I would rather defer till my second address your Swanage Gavial, and hope before that time that you will send me a brief notice, however short, for our proceedings on the same, though I hold that no public christening of any new-born fossil is valid unless a description accompanies the new names sufficient, as Dr. Beck would say, 'for a diagnosis.' I had not time to tell you when you were here, how much I apprehend that the architect will run away with whatever money a zeal for science or friendship and regard for you may raise by subscription at Brighton. I remember that when some 8,000*l.* had by a great effort been got together at Bristol, for lectures, and for a collection of books and other useful aliment for the mind, as the misguided projectors thought; in came the architect, gave them a handsome building, pocketed the cash, and left them with a room for the newspaper readers, and scarce a farthing to pay their invaluable curator Millar. So it was with the London Literary

Institute in Moorfields—about thirty or forty thousand pounds sunk, and a hundred other cases. Yet unwarned by experience, the planners of the London University followed in the same track, and spent several hundred thousand pounds in erecting a huge and never-to-be-finished edifice with a splendid portico, costing alone 30,000*l.* or 40,000*l.*, and leaving nothing for professors but debt. Then came the King's College, and another splendid subscription, for there is no end to the gullibility of John Bull. Might not anyone have told the poor parsons, who with an honest zeal for their cause, put down their 5*l.* or 50*l.*, that it was not science, nor learning, nor religion, nor anything but *architecture* that is encouraged by such munificent donations in England. Had they hired a set of the ugliest houses in the Strand, and bribed, with their two or three hundred thousand pounds, the first teachers in Great Britain, they would have carried everything before them. But what did they do? Reared a huge wing of a building which swallowed up all the money, and is now unfinished inside, although part of it, contrary to the original plan, is fitted up for students' private chambers. There is no hope for natural history or science, or literature, until they *precede*, instead of following, the architect. I sat next a pupil of the late G. Rennie at dinner the other day, and he attributed the success and large fortune of that engineer, not so much to his civil engineering, though of course he was eminent in that, as to his knowledge of men and of human nature. He told his pupil that to *work* the original plans or designs was a small affair comparatively—the great business was 'to work the committee.' So some skilful architect at Brighton will be found, who will have tact enough 'to work' your sub-committee, with your friend Horace Smith at the head of it. He will not frighten them with too large an estimate at first, but let it be at least some hundreds under the subscription, for he knows that so many gentlemen of taste and leisure will see improvements that may be made as the work proceeds, and to these he, who has the *working* of them, will after a decent show of resistance accede, and then he may lay to the charge of their departure from the first plan all excess above the estimate. Having spent all the money and

mortgaged the handsome edifice, there will be nothing left for the Mantellian collection, and still less for lectures. Try and preach against this, though I have but a faint hope. The 'Challenger' frigate, when wrecked in Chili, and in the midst of danger and distress, fired a gun to warn a Swedish vessel off the breakers, and she was saved: it was a generous act. I am reading their diary. I wish some of our bankrupt scientific institutions would fire guns of distress.

Yours ever most truly,

CHARLES LYELL.

To SIR J. W. HERSCHEL.

London: June 1, 1836.

My dear Sir John Herschel,—If anything could have made your letter of February 20 last more welcome and useful to me, it was the time when it reached me, just as I was unexpectedly called upon by my publisher to interrupt my other scientific occupations by preparing a new or fifth edition of the 'Principles of Geology,' the fourth edition of two thousand copies having been nearly all sold in one year. The continued sale of the work is a sufficient earnest of its having been written in a popular style, in attempting to accomplish which I devoted so much time, that I have sometimes thought it was scarcely justifiable, and might have been better employed, but the interest you have expressed, and the fact of your having read the book three times, and your approbation of one of the newest parts of the treatise, 'the climate theory,' is a much better test to me than the sale, being something solid and substantial in my labours. I may truly say that when the Royal Society voted me a medal for my book, I was not more gratified nor more encouraged than by your full and interesting comments which have given me a feeling of strength and confidence in myself, which will assist me in my future studies. First I shall take this opportunity of thanking you for the manner in which when writing long ago in the 'Transactions of the Geological Society,' on the effects on climate which variations in the earth's eccentricity might have produced,

you alluded to my notice of the variable quantity of light and heat received by the two hemispheres during the precession of the equinoxes. You contrived so to set me right in a great blunder, as to make it appear as a compliment, and I was able to correct it in after editions as you see. I went over this subject and your paper with Mr. James Bowstead, of Corpus Christi College, Cambridge, who made me understand with tolerable clearness the mathematical part of the reasoning, which appeared to me most beautiful, and made me regret that I had not given some of the years which I devoted to Greek plays and Aristotle at Oxford, and afterwards to law and other desultory pursuits, to mathematics. The life of a geologist is too short to repair that deficiency, and in this and other matters we must borrow of others. With this I send a copy of my first President's speech, in which I have dwelt somewhat at length on the controverted point of the elevation of land by earthquakes. Perhaps in my next address I shall limit myself less to the papers read at our meetings in the year, but as a rule I rather grudge the devotion of time to such reviews, and to official duties, which some people like, but which are not to my taste, and fritter away one's time and thought; and certainly if working men of science must perform such duties, no Presidentship ought to be more than biennial. I sometimes make some of my friends here very angry, by congratulating them as friends to science that we failed in making you perpetual President of the Royal Society. Just now the society's chair may be said to be in abeyance, but it continues to be a good and rapid publishing machine, and at all events it has not to answer for the sin of annihilating part of your time in choosing officers, writing *éloges*, attending councils, &c. &c., which I think a man of good fortune and tolerable abilities, without genius, or great acquirements, may perform very well. What we most suffer by now, is the too great facility of admission, which nothing can effectually check but the President's tact and firmness.

I shall send you my fifth edition as soon as it is printed, and you will see that your information about the boiling of seeds has been useful, and that I have attended to other corrections. Your very interesting volcanic theory was too much for me to attempt to grapple with, as an intercalation

into my book, at least this time; but I mean to have a work at it this summer as soon as I have got through the reprint. It struck me on first reading as singularly like a speculation of Babbage's, which he appended to a paper of his on the Temple of Serapis; and of which an abstract appeared in the 'Proceedings' of the Geological Society which I suppose you have, although in case you should not, I will send you a copy if I can procure it. I have just seen an 'Observer' Sunday paper, in which you are made to 'set at rest' some curious points in the planet which received Astolfo's brains. Mrs. Calcott (Maria Graham) promised me a letter which I think would be useful at Rio de Janeiro, but I have not yet received it, probably because she has been so ill. I am glad to hear that your thoughts are bent homeward. What you say of the basaltic and granitic dikes is very interesting. I am so busy with my printer, that I shall not digest all that till I get into the country, our geological session being just over. I go to my father's in Scotland with my wife for two months, and afterwards away to the west of Scotland, and I hope Arran for a month, and return by the end of September. We dine to-day (June 4) with the Somervilles, and in the evening Babbage gives one of his evening meetings which are very brilliantly attended by fashionable ladies, as well as literary and scientific gents, and where one meets with persons high in all professions, and with distinguished foreigners. You remember Fitton's 'Philosopher Turnstile,' but we must take men as they are, and Babbage must be admitted to have really succeeded in commanding the respect and admiration of persons not only of the first talent, but not a little even of fashion and beauty, and I maintain that he has done good, and acquired influence for science by his parties, and the manner in which he has firmly and successfully asserted the rank in society due to science. I believe he works hard now in spite of the time he must give to the arrangement of his parties, and to society. I think Whewell's report on mineralogy very good in 'British Association Reports,' which I have just read. Murchison's book will scarcely be out this year, and as for Buckland's 'Bridgewater,' we are tired of waiting for it, as it has been reviewed in the 'Quarterly' two months. He says it will

be out in six weeks. Babbage has promised a ninth 'Bridgewater,' in which 'the Devil is to have his due,' and he has actually written a part of it. Sedgwick has been giving very useful and popular lectures in geology at Norwich, where he is now Prebendary. Fitton is at last, we believe, at the point of being delivered of the Green Sand paper, on which occasion we trust that the shock of an earthquake may not throw down our museum. I always made up my mind it would be a posthumous production. He is as amiable as ever, and if he was not such a procrastinator would have done much for us—as being so good a writer.

When I was at Copenhagen the year before last, Oersted, who had just received your nebula paper in the 'Philosophical Transactions,' expressed the greatest admiration of it, and endeavoured to make me comprehend what he thought 'the poetry' of some of the speculations, but it was far beyond my depth in mathematics. You have not in Europe a more sincere admirer than he.

I shall now conclude, and add in another hand[1] some other remarks, and perhaps send the whole before I get the introduction to Rio, which shall follow. I hope some day to have the pleasure of introducing my wife to Lady Herschel. In the meantime believe me, ever faithfully yours,

CHARLES LYELL.

P.S. In regard to the origination of new species, I am very glad to find that you think it probable that it may be carried on through the intervention of intermediate causes. I left this rather to be inferred, not thinking it worth while to offend a certain class of persons by embodying in words what would only be a speculation. But the German critics have attacked me vigorously, saying that by the impugning of the doctrine of spontaneous generation, and substituting nothing in its place, I have left them nothing but the direct and miraculous intervention of the First Cause, as often as a new species is introduced, and hence I have overthrown my own doctrine of revolutions, carried on by a regular system of secondary causes. I have not wasted time in any contro-

[1] Mr. Lyell had frequently to employ an amanuensis to save his weak eyes.

versies with them or others, except so far as modifying in new editions some opinions or expressions, and fortifying others, and by this means I have spared a great deal of ink-shed, and have upon the whole been very fairly treated by the critics. When I first came to the notion, which I never saw expressed elsewhere, though I have no doubt it had all been thought out before, of a succession of extinction of species, and creation of new ones, going on perpetually now, and through an indefinite period of the past, and to continue for ages to come, all in accommodation to the changes which must continue in the inanimate and habitable earth, the idea struck me as the grandest which I had ever conceived, so far as regards the attributes of the Presiding Mind. For one can in imagination summon before us a small past at least of the circumstances that must be contemplated and foreknown, before it can be decided what powers and qualities a new species must have in order to enable it to endure for a given time, and to play its part in due relation to all other beings destined to coexist with it, before it dies out. It might be necessary, perhaps, to be able to know the number by which each species would be represented in a given region 10,000 years hence, as much as for Babbage to find what would be the place of every wheel in his new calculating machine at each movement.

It may be seen that unless some slight additional precaution be taken, the species about to be born would at a certain era be reduced to too low a number. There may be a thousand modes of ensuring its duration beyond that time; one, for example, may be the rendering it more prolific, but this would perhaps make it press too hard upon other species at other times. Now if it be an insect it may be made in one of its transformations to resemble a dead stick, or a leaf, or a lichen, or a stone, so as to be somewhat less easily found by its enemies; or if this would make it too strong, an occasional variety of the species may have this advantage conferred on it; or if this would be still too much, one sex of a certain variety. Probably there is scarcely a dash of colour on the wing or body of which the choice would be quite arbitrary, or which might not affect its duration for thousands of years. I have been told that the leaf-like ex-

pansions of the abdomen and thighs of a certain Brazilian Mantis turn from green to yellow as autumn advances, together with the leaves of the plants among which it seeks for its prey. Now if species come in in succession, such contrivances must sometimes be made, and such relations predetermined between species, as the Mantis, for example, and plants not then existing, but which it was foreseen would exist together with some particular climate at a given time. But I cannot do justice to this train of speculation in a letter, and will only say that it seems to me to offer a more beautiful subject for reasoning and reflecting on, than the notion of great batches of new species all coming in, and afterwards going out at once. Your facts about the boiling of seeds are very curious, and I have availed myself of them most gladly in my fifth edition.

I wish much you could measure exactly the temperature of the great hot springs which you mention in the Brand valley, or get some one to take their temperature at different seasons. The observations will perhaps only become of importance like some of those which you have made in astronomy, many generations or centuries hence, when a comparison would show an increase or decrease of heat. It would be well to point out to the Literary and Philosophical Society which you have founded at the Cape (as I heard from Major Cloete), the remarks which Forbes has made on the light which such observations may throw on the heat of the interior of the earth, when comparisons are made after considerable intervals of time. (See Forbes, 'Proceedings of Royal Society,' No. 24, p. 382.)

I forgot to remark on what you say of the argument of the originally limited distribution of plants being capable of being inverted. You will at least find that I have precisely anticipated the necessary occurrence of such ambiguous phenomena at vol. iii. p. 165, in the paragraph beginning 'If the views.' But I anticipate that geology will hereafter enable us to determine in many cases which of the recent species, now having a confined range, are the last survivors of species once more flourishing, and which are the newly introduced and infant colony destined to become a great nation in future.

C. L.

To Sir John Herschel.

16 Hart Street, Bloomsbury: June 7, 1836.

My dear Sir John Herschel,—A few days ago I sent to Captain Beaufort a long letter which I had written to you, in which I hoped to enclose some letters of introduction to persons at Rio, as you wished. I now enclose them, together with the abstract of Babbage's paper to which I alluded. Pray if you have time to look out any marginal criticisms on parts of my book, send them to me. Yesterday I sat next Babbage at Miss Rogers' at dinner, and asked for the abstract which I now send. Mr. Rogers, the poet, was talking of your astronomy which he had read, as well as the introduction to 'Natural Philosophy,' and with both of which he had been much delighted; and among other things, with the manner in which you had alluded to certain papers of Dr. Young's on light and colour, which Brougham had so presumptuously and unmercifully cut up in the 'Edinburgh Review,' as Arago has remarked in his *éloge* of Young. I think it was Sydney Smith who said of Brougham that he had made two great discoveries in the 'Edinburgh Review'—the first was that Byron was no poet, the second that Young was no philosopher—for Jeffrey had nothing to do either with the attack on Young or with that on Byron.

Hoping you will receive this and my former letter at one time, Believe me, ever sincerely yours,

Charles Lyell.

To G. Mantell, Esq.

Kinnordy, Kirriemuir, N.B.: July 6, 1836.

My dear Mantell,—Here am I rusticating in a very beautiful country, not too hot, but with weather much like a fine English spring. I am now and then devoting some stray hours to my 'Elements,' like Buckland's 'Bridgewater,' long promised—but not yet reviewed, thank heaven. I have received a very pleasant letter from Alexander Burnes, who has returned to Cutch and re-examined the delta of the Indus. He reports that the submerged tract which sank in 1819 is *in statû quo*. He has sent me off some Cutch secondary fossils, ammonites, belemnites, &c. His letter came in nine

weeks per steamer from Cutch! I am glad to escape awhile from the excitement of London, and wish I could hear of your doing so from Brighton, but fear from your last letter that there is no immediate prospect of that.

A letter from Dr. Silliman informs me that my 'Principles' are being reprinted at Philadelphia, and nearly ready. John Murray was in hopes he had reduced the price so as to prevent this happening.

I shall be here for more than a month, then go with my wife to geologise in Arran, then return here, and afterwards in September, or perhaps October, to London. If you send a letter to 16 Hart Street, it will be forwarded to me, and do give me a full account.

To G. MANTELL, ESQ.

Kinnordy, Kirriemiur, N.B.: September 19, 1836.

My dear Mantell,—I have written to invite Dr. Fleming to pay us a visit here, and he has accepted for to-morrow, so when we meet, or when I next write, I will tell you how he looks. I am sorry to say he has had much ill health. I suppose you know that he got his living of Flisk—the smallest in emolument in the East of Scotland, and where he had been for most of his life, 'like a pony tethered on a highland moor'— exchanged for a much better living in Fife, where he was quite adored by his parishioners, but so great was the duty that it left not a moment for a conscientious man to devote to science or literature, and was almost too fatiguing for his health. It was therefore most natural that he should have sighed for a professorship in a Scotch University, which gives a six months' vacation every year. After several applications in vain for chairs more consistent with his zoological and botanical acquirements, he accepted one in Aberdeen, of Natural Philosophy I think it was called, which no doubt has given him much fag to get up arrears of mathematical knowledge. But unfortunately, something worse than the lectures fell to his hard fate. Several University bills and a Royal Visitation caused tremendous secretarian or clerk's labour to fall on the Junior Professor, who is obliged to serve as secretary to the University.

You will see by this that you, my good friend, are not

singular in finding it difficult to gratify your liberal thirst for science, without interfering with professional profits. Really, as Milman says, it would be well for the country if, instead of abolishing prebendal stalls, they were given to clerical and lay cultivators of literature and science, who had shown that they would devote energy and superior talents to those departments. When Babbage was taunted one day by a Conservative with 'What do you mean to be when the revolution comes?' he said, 'Lay Archbishop of Winchester.' A few comfortable scientific sinecures would be good things, but I fear they might become useless like University fellowships.

Did you read those lines in the 'Morning Chronicle' about the 'Aristocratodon,' and the 'Episcopus Vorax'? I wonder who wrote them! There is an attack in the 'St. James's Chronicle' on Buckland, for having said at Bristol that the world was millions of years old. Mr. Horner tells me that Lonsdale is looking better, but thinking himself still ill—he has worked like yourself too hard; half what either of you have done would have finished me.

I hear that Fitton's 'Greensand' is printed, but still he is *polishing* it. I trust that for his and our sakes I shall find it done when I get to town.

Ever most truly yours,

CHARLES LYELL.

To HIS FATHER.

16 Hart Street, London: October 4, 1836.

My dear Father,—I hope my mother received a letter which I put into the General Post Office on Friday, on our arrival here. We called, after church on Sunday, upon Dr. and Mrs. Fitton in Portland Place, and saw them both; he very well, and she wonderfully recovered from a severe illness. I had much talk with him about the Presidentship, which he would on no account accept, 'having the weight of eight children upon him.' He was glad to hear that I had offered the chair to Lord Northampton, which he said would not have occurred to him, and which was a proper compliment, and one of which Lord N. would feel the value, knowing that our Presidentship had not been conferred on *rank*.

I asked if he had thought of Broderip. He said yes, of course, and had felt, as I probably had, that he ought not to accept it, as knowing nothing of geology; I agreed to this, and wondered that it should be so. Fitton said, 'It is truly marvellous, with his love of natural history and deep knowledge, that he should not even have made any progress in fossils, that he should have served three entire years as secretary of the Geological Society, and so well,—should have edited a volume of the "Transactions," gone through your second volume of "Principles," and Buckland's "Bridgewater," and remain so ignorant of the "Elements"—indeed, he rather prides himself, I think, on the inaptitude of his mind for geological reasoning, and most dexterously has he cleared all the hoops of geology.' On my laughing at his simile, he said, 'You know that Pope has it so in the "Dunciad,"

> 'Never by tumbler through the hoops was shown
> Such skill in passing all, and touching none.'

Upon this we told Fitton that we had guessed him to be the author of the verses in the 'Morning Chronicle,' on 'Aristocratodon,' &c. 'Oh no, you give me a great deal too much credit for powers of versification; they were by Tom Moore.' 'But how came he by so much geology?' 'Why, he got it up partly at Bristol, and partly from Babbage, who was much with him there.' He then told us, what Gardner the mapseller has since confirmed, that Buckland's edition of 5,000 of the 'Bridgewater' is all sold, and 5,000 more printing, each of which editions, Fitton says, will produce the professor 2,000*l.*—a piece of news I am truly glad to hear, for from what I have read of the book, I think it will do much good in spreading correct notions of the science, and probably popularise it much. Murchison calls it 'Bridge-over-the-water;' and really that part which is to carry us over the abyss of cosmogony is better constructed than I expected, though I should have been sorry to have had to trust myself upon it. Fitton thinks the moral of it to be, that words may mean anything we like, or that science may require a dangerous rule in its general application. However, the splendid sale shows that you were right in thinking that the newspaper attacks of the Nolans would prove mere fleabites. I have seen Stokes, who was delighted with the first

batch of ferns, and has the *Botrychium lunaria* still alive, and thriving under a glass case, together with exotic ferns and New Holland orchidæ in full flower.

September 5.—Murchison drank tea here yesterday evening, and gave us an account of the Bristol doings, and his own tour with Sedgwick, and other geological news. I told him I thought of proffering the President's chair to Whewell, which he thought a capital hit, and I have accordingly sent a strong letter to Whewell to-day.

Every one is quite struck with the improvement in Mary's health and appearance, especially Mr. Murchison.

Mr. Stokes dines with us to-day, quite alone, and is to look over the ferns. We hear that Babbage is in town, among others, in this emptiest of seasons. Murray is looking well and prosperous, and asked politely after you. The Honourable Mrs. Norton came out of Murray's as I went in, and had been showing him the MS. of a publication of her own. She told him she was living with her mother —he had been much struck with the quiet and modest appearance of the authoress.

Mary desires her kindest love, and believe me, ever your affectionate son,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

16 Hart Street, Bloomsbury: December 26, 1836.

My dear Sir,—I have read your paper with the greatest pleasure, and should like to point out several passages which require explanation, and must have a word or two altered, but it would be impossible in a letter. I have made notes on them, and hope you will call here before you read the paper. Will you come up on Monday, January 2, and come and dine with us at half-past five o'clock, or come at five, and I will go over the paper before dinner? No one dines with us but Mr. and Mrs. Horner and one daughter, and Mr. Horner will be glad to renew his acquaintance with you.

We dine early, because we have one of our small early tea parties, and one or two are to be here, to whom I should like to introduce you, besides a few whom you know already.

If you cannot get here to dinner, you must if possible join the evening party.

The idea of the Pampas going up, at the rate of an inch in a century, while the Western Coast and Andes rise many feet and unequally, has long been a dream of mine. What a splendid field you have to write upon!

I have spent the last week entirely in comparing recent shells with fossil Eocene species, identified by Deshayes. When some great principle is at stake, all the dryness of minute specific comparisons vanishes, but I heartily long for some one here with a collection of shells, and leisure to talk on these matters with. Lonsdale is overpowered with work. Don't accept any official scientific place, if you can avoid it, and tell no one that I gave you this advice, as they would all cry out against me as the preacher of anti-patriotic principles. I fought against the calamity of being President as long as I could. All has gone on smoothly, and it has not cost me more time than I anticipated; but my question is, whether the time annihilated by learned bodies ('par les affaires administratives') is balanced by any good they do. Fancy exchanging Herschel at the Cape, for Herschel as President of the Royal Society, which he so narrowly escaped being, and I voting for him too! I hope to be forgiven for that. At least, work as I did, exclusively for yourself and for science for many years, and do not prematurely incur the honour or penalty of official dignities. There are people who may be profitably employed in such duties, because they would not work if not so engaged.

Whenever you come up, you must be here on Wednesday, and if you like to dine at the club do so. There is no vacancy, but you stand the first of those who are knocking at the door for admission.

Yours very truly,

CHARLES LYELL.

CHAPTER XXI.

MARCH—NOVEMBER 1837.

DOCTRINE OF UNIFORMITY—DINNER AT MISS ROGERS'—BABBAGE'S NINTH BRIDGEWATER TREATISE—LETTERS TO HERSCHEL ON CORAL ISLANDS—COPENHAGEN—INVENTION OF ELECTRIC TELEGRAPH—VISIT TO SORGENFRI—NORWAY—GEOLOGY—PARIS—VON BUCH—MDLLE. MARS—NEW RAILROAD—BARRIÈRE DE L'ETOILE—RETURN TO LONDON—PARTIES.

[Mr. and Mrs. Lyell went to Denmark and Norway in 1837, returning home by Brussels and Paris. The 'Elements of Geology' was published in the following year 1838, and he attended the British Association at Newcastle, presiding over the Geological Section. In 1839 he visited Norfolk and Suffolk, and went to Birmingham to the British Association.

In 1840 he made a tour in Normandy and Touraine, and was at the British Association at Glasgow, presiding over the Geological Section. In the following year 1841 he was invited to give a course of twelve lectures at the Lowell Institution, in Boston, Massachusetts, and he travelled through much of the United States and Canada, collecting materials for memoirs which were afterwards published in the Geological Society's Journal.

In August 1843 he went to Bristol to examine the coal mines in that district, and he and his wife proceeded to Cork, where the British Association was held.]

CORRESPONDENCE.

To the Rev. W. Whewell.

16 Hart Street, Bloomsbury Square: March 7, 1837.

My dear Whewell,—As we had some conversation the other day touching the extent to which I carried my doctrine of 'Uniformity,' in the 'Principles of Geology,' I wish to refer you to the first edition of that work (with which you, as the historian of the science, are of course principally concerned), in order to show you that certain passages were somewhat unfairly seized upon by the critics, and not duly considered with and interpreted by others, and by the context generally of the first volume.

You know much more of geology now than when you first read my book, or Sedgwick's comments upon it; judge me, therefore, by your present knowledge, rather than by the first impression.

Any reader of Sedgwick's Anniversary Address to the Geological Society of 1831, would suppose that I had contended for 'an indefinite succession of similar phenomena,' and coupling what is said about my hypothesis of a 'uniform order of physical events' with what Sedgwick afterwards says of the recent appearance of man, it might naturally be imagined that I had not made due allowance for this 'deviation,' as I myself styled the creation of man. I brought forward this 'innovation' prominently as a new cause, 'differing in kind and energy from any before in operation,' and mentioned it as an unanswerable objection against anyone who was contending for *absolute uniformity*. I stated the sense in which I believed the system of terrestrial change to be uniform, and that the modifications produced by man had been exaggerated, but in the following page I admitted that they are 'a real departure from the antecedent course of physical events.'

It was impossible, I think, for anyone to read my work, and not to perceive that my notion of uniformity in the existing causes of change always implied that they must for ever produce an endless variety of effects, both in the

animate and inanimate world. I expressly contrasted my system with that of 'recurring cycles of similar events.' If certain passages could easily be selected in which the theory of uniformity was, perhaps, stated too broadly as an abstract proposition, and the most striking of these Sedgwick has cited in his address, still the great point of difference between me and most of my predecessors, and between me and Sedgwick, then and now, is not one which implied on my part any unphilosophical solecism. I never drew a parallel between a geological and an astronomical series or cycle of occurrences. I did not lay it down as an axiom that there cannot have been a succession of paroxysms and crises, on which '*à priori* reasoning' I was accused of proceeding, but I argued that other geologists have usually proceeded on an arbitrary hypothesis of paroxysms and the intensity of geological forces, without feeling that by this assumption they pledged themselves to the opinion that *ordinary forces and time* could never explain geological phenomena. The reiteration of minor convulsions and changes, is, I contend, a *vera causa*, a force and mode of operation which we know to be true. The former intensity of the same or other terrestrial forces may be true; I never denied its possibility; but it is conjectural. I complained that in attempting to explain geological phenomena, the bias has always been on the wrong side; there has always been a disposition to reason *à priori* on the extraordinary violence and suddenness of changes, both in the inorganic crust of the earth, and in organic types, instead of attempting strenuously to frame theories in accordance with the ordinary operations of nature.

Read also, if you desire to be a fair arbiter between the philosophical spirit and practical results of the two different methods of theorising in geology, what Sedgwick says in his Address for 1831 of De Beaumont's system of parallel elevations, and my chapter on the same subject, or on the relative antiquity of mountain chains. De Beaumont's system was properly selected by him as directly opposed to my fundamental principles. It was well selected, because it not only assumed returning periods of intense activity, or, as Sedgwick termed them, 'feverish spasmodic energy,' which tore asunder the framework of the globe, but also violent and

concomitant transitions from one set of species to another. It also assumed the parallel direction of mountain chains contemporaneously elevated, whereas we know that the modern lines of active volcanos and earthquakes are not parallel in our own times. It was a theory invented not only without any respect to the reconciling geological events with the ordinary course of changes now in progress, but it evinced at every step that partial leaning to a belief in the difference of the ancient causes and operations which characterise the system of my opponents. The astonishing eagerness with which Sedgwick caught up and embraced the whole of what he termed De Beaumont's 'noble generalisation,' his declaration that De Beaumont's theory was 'little short of physical demonstration,' and that it had given him (Sedgwick) 'a new geological sense, a new faculty of induction;' his assertion that he was 'using no terms of exaggeration' in saying all this; was all prompted by the same theoretical bias which assumes the discordance between the former and existing course of terrestrial change. Before Sedgwick published his Address, I had fully explained to Lonsdale my objections to De Beaumont's theory, the same which I have since published. I know not how much of De Beaumont's theory Sedgwick now believes, probably but a small part of it. I can only say that I could not find in Switzerland any one of those who had studied its application in reference to the Alps and Jura, as for example, Studer, Necker, and Thurmann, who believed in it. Conybeare could not reconcile it to England. Sedgwick considered that my mode of explaining geological phenomena, or my bias towards a leading doctrine of the Huttonian hypothesis, had served like a false horizon in astronomy to vitiate the results of my observations. But has he not himself been unconsciously warped by his own method of philosophising, which he has truly stated to be directly at variance with mine? I am willing to test the relative value of our modes of dealing with these subjects by all the examples which he has himself chosen in his review of my book.

In the review in the 'British Critic,' in which more justice was done to the real points of originality to which my work could lay claim, than in any subsequent article upon it

(although most of them are much more eulogistic), you stated three formidable theses which I had undertaken to defend, in order to bear out my theoretical views; how much less formidable must they now appear to yourself when you and the science have made seven years' progress, than they did in 1830! I am sure that none of the propositions can now seem to you extravagant or visionary, although you may not wholly agree with all my views. I allude to, first, the adequacy of known causes as parts of one continuous progression to produce mechanical effects resembling in kind and magnitude those which we have to account for; secondly, the changes of climate; thirdly, the changes from one set of animal and vegetable species to another.

In regard to this last subject, as well as to the change of climate, you remember what Herschel said in his letter to me. If I had stated as plainly as he has done the possibility of the introduction or origination of fresh species being a natural, in contradistinction to a miraculous process, I should have raised a host of prejudices against me, which are unfortunately opposed at every step to any philosopher who attempts to address the public on these mysterious subjects. Perhaps you would understand the difference which I conceive to exist between me, as a Uniformitarian, and my opponent the Catastrophist, if I put an imaginary case in your own department of the tides. Suppose it was recorded, on authority which you did not question, that at a certain period of the past, say 10,000 years ago, a remarkable inequality, or an unusual rise or fall of the tides took place, or a long suspension of tidal oscillations. You are asked to explain it. After much thought, you declare that every hypothesis has failed, and that you give it up as inexplicable. Some one proposes a theory founded on a supposed periodical increase or diminution in the quantity of matter contained in the sun or moon, or in both of those heavenly bodies. You object that it is unphilosophical to resort to any such guesses, especially until we have laboured for a much longer time in making and recording observations on the tides, and in speculating on all the possible combinations of astronomical and terrestrial circumstances, which in the course of thousands of ages may affect the tides.

Your antagonist replies: 'Why is it unphilosophical? What right have you to assume that the power of the sun and moon to attract the earth is uniform, or why may there not have been two satellites formerly to the earth instead of one? The same power which created man, and gave him the dominion over the earth, may at any time create and then annihilate a heavenly body, or change the volume or density of those which now exist.' You might reply: 'I admit the possibility of these changes in the system, but they are mere arbitrary conjectures. I feel much more confidence in the probable uniformity in the condition of the heavenly bodies for an indefinite period of time, whether past or future, than I feel in my own knowledge. If I was sure that I could see at a glance the effects of every possible combination of existing causes—such as variations in the eccentricity of the earth's orbit, fluctuations in the shape of the bed of the ocean, or in the position of continents, and many others—then perhaps, all others failing, I should venture upon some such theories as you have proposed. But I hesitate now, more especially when I recollect that several problems in the former state of the tides, once referred to violations in the ordinary conditions of our solar system, can now be explained without resorting to such expedients, and are, in fact, found to be the consequences of known and regular causes.'

I find that I cannot draw the above parallel as closely as I could wish, because I cannot fancy in reference to the tides any stumbling block to arise out of prejudices in regard to *time*. The difficulty which men have of conceiving the aggregate effects of causes which have operated throughout millions of years, far exceeds all other sources of prejudice in geology, and is yet the most unphilosophical of all. On this I have said much in my work, and people are now much better prepared to believe Darwin, when he advances proofs of the slow rise of the Andes, than they were in 1830, when I first startled them with that doctrine.

I will only add that Sedgwick was wrong if he imagined that I began with *à priori* reasoning on any assumed uniformity of physical events. I was taught by Buckland the catastrophical or paroxysmal theory, but before I wrote my

first volume, I had come round, after considerable observation and reading, to the belief that a bias towards the opposite system was more philosophical.

Believe me, dear Whewell, ever faithfully yours,

CHARLES LYELL.

To HIS SISTER.

London: March 19, 1837.

My dear Sophy,—I shall trust to Mary giving you the regular journal of our proceedings, and shall indulge myself in recalling to my recollection what passed at our last dinner on Friday at Miss Rogers'. Much was said which I should be sorry to forget, and the guests were some of them remarkable and new to me. The party were twelve in number: Miss Rogers and her brother, Lord and Lady Holland, Mr. and Mrs. Milman, Mr. Allen, Mr. Luttrell, Mr. Empson, Sir David Wilkie, and ourselves. The table, so arranged as that everyone could hear and be heard by others, two sitting at the top, Lord Holland and Miss Rogers, and two at the bottom, Mr. Rogers and Mr. Milman. No epergne or other interference in the centre of the table; lamp from the ceiling; table just wide enough, and no more. Mr. Allen has been for thirty years physician to the Holland family; lives with them on a very independent footing; wrote much in the early 'Edinburgh Review' on Spanish literature and other subjects; an agreeable man of Lord Holland's age. All we know of Luttrell is that he is a diner-out, and much in a literary set. Empson you have heard us speak of before, as a writer and professor of law at Haileybury. Mary was well placed between him and Lord Holland; the latter has a cheerful, good-humoured expression, talking in a lively way, but never too much, of literary rather than political subjects, and of anecdotes of political men rather than politics. Mr. Allen was saying how strange a contrast Erskine[1] used to be in and out of his lawyer's wig and gown. Out of it he talked in a most *gauche* and foolish way, in it so that you would trust your life and fortune in his hands. Lord Holland, among other

[1] Younger son of the tenth Earl of Buchan, an eminent lawyer, and became Lord Chancellor.

stories to confirm this, said that one day when he and Lord Erskine were in council in the Cabinet, and Lord Erskine's opinion on a measure was asked, he said in a hasty manner, 'Oh, yes, depend upon it, it must be, for I remember it was in an old Presbyterian book of prophecies which my mother had.' When Erskine first came to the bar, he spoke very broad Scotch; he had never read more than the Bible, Shakespeare, Milton; and in three years he spoke eloquent English, and was quite a gentleman in manners.

A discussion arose as to whether the Iliad and Odyssey were both written by the same poet. Lord Holland said he felt satisfied they were not. Milman agreed, but contended for the unity of the Iliad, and said that the arguments against it founded on the difficulty of transmitting so long a poem without printing, were answered by a greater wonder of the same kind being achieved, in the handing down of much longer Sanskrit poems. He said that Asia Minor was never once mentioned in the Odyssey, which was probably the work of an inhabitant of the Peloponnese, whereas the allusions in the Iliad are so much confined to Asia Minor. On the Etruscan tombs being talked of, towards the exhibition of which Mr. Rogers had liberally contributed, we got upon the old Etruscans, and Niebuhr and his Roman History. Lord Holland said that he never would give up the real existence of such men as Romulus and Numa, however much fable might be mixed up with them. Milman thought Niebuhr more successful in pulling down than in building up. After the ladies were gone, Lord Holland asked me about Buckland's book, and whether he knew much of geology. He seemed not to have formed a high estimate of the said Bridgewater, so I spoke up in favour of the body of the work, on fossils. This led to a talk on new species, and that mystery of mysteries, the creation of man. Lord Holland said that we were no further on that point than Lucretius, out of whom he could take mottoes which would have done for each of my volumes. And now, Sophy, if you think that I am voting you too blue by administering all this Greek, Sanskrit, Etruscan, and Latin to you, hand over the dose to Papa, and he may retaliate whatever he pleases with some lucubrations equally learned from his den.

But I have said nothing of Lady Holland, who took her share in the talk. She asked me about the Danes and Swedes, knew the names, at least, of many of them distinguished in science, said how much energy and love of truth there was in the Northern men of letters, as compared to her favourites the French and Italians, yet the French could be deep and persevering. I spoke of La Place and Cuvier. She said that the latter once wished her to compliment him on his promotion to a higher political place, but she gave him fairly to understand how much she lamented his having abandoned the line in which he was so great, to meddle with politics (in which he played so inferior and, in her opinion, unworthy a part). It is impossible to say in a letter anything which will give an idea of the singularity of Lady Holland's way of questioning people, like a royal personage. It is impossible not to be sometimes amused, and sometimes a little indignant, with her. I cannot say that I formed so high an estimate of her talent and power as to explain to me how she has righted herself to such an extent, and got on in society after all that happened more than thirty years ago. No doubt she has been in the interval prudent, and more strict in the choice of her society than others who had infinitely more right to be so. She had wealth and beauty, of which last there are still some remains yet, with an expression of temper. But then she had a husband who had not only talent, rank, and political station, but an infinite fund both of wit and good humour.

With love to all at Kinnordy, believe me, my dear Sophy,

Your affectionate brother,

CHARLES LYELL.

To CHARLES BABBAGE, ESQ.

May, 1837.

My dear Babbage,—I have read the 'Fragment'[2] with great interest, and think very favourably of it and its originality. As the machine must come in so much unavoidably, I think one apology at the beginning would do, or rather an explanation that the work is founded on it. The argument

[2] The *Ninth Bridgewater Treatise*, a Fragment, by Charles Babbage.

of changes of laws comes home to some of my geological speculations. No doubt some people would not like any reasoning which made miracles more reconcilable with possibilities in the ordinary course of the universe and its laws; but you do not write to please them.

They are shocked at the idea of an eruption of a volcano being foreknown, which was to destroy Sodom and Gomorrah, but your break in the sequence is more of a miracle than a volcanic eruption. I think your estimate of the Creator's attributes much higher than theirs, and that everyone may follow so far.

Ever faithfully yours,

CHARLES LYELL.

To HIS SISTER.

London: May 3, 1837.

My dear Caroline,—Many thanks for your letter, which Mary tells me she has answered. I rather envy her the dinner to-day, though if Mr. Whitmore had not known that I was engaged at the Geological Society Club, neither of us would have been asked, as he wanted one place, and filled by a lady. His parties are excellently arranged. Jacquemont's letters have made us both curious to see Lord William Bentinck, and indeed his lady also. The Bishop of London talked of Sedgwick having narrowly escaped, according to report, being made Bishop of Norwich. I told him how popular Whewell had told me that Sedgwick had become at Norwich, which interested Dr. Blomfield, and he ended by saying, 'Though he is so popular, with the ladies in particular, I hardly think he will ever marry now.'

I have at last struck out a plan for the future splitting of the 'Principles' into a 'Principles' and 'Elements,' as two separate works, which pleases me very much, so now I shall get on rapidly. The latest news is, that two fossil monkeys have at last been found, one in India contemporary with extinct quadrupeds, but not very ancient—Pliocene perhaps—another in the south of France, Miocene and contemporary with Paleotherium. So that, according to Lamarck's view, there may have been a great many thousand centuries for

their tails to wear off, and the transformation to men to take place.

Your affectionate brother,
CHARLES LYELL.

To SIR JOHN F. W. HERSCHEL.

16 Hart Street, Bloomsbury, London: May 24, 1837.

My dear Sir John Herschel,—I shall shortly set out with my wife on a tour to Copenhagen, Christiania, and Berlin, and will not quit London without writing to explain to you some steps which I have taken in regard to the publication of extracts from your letter to me of February 1836. You had given Murchison permission to read, when occasion offered, a note of yours on the subject of the Origin of Volcanos, and the outward movement of the internal isothermal lines on the superposition of new deposits, or 'additional clothing.' You seemed to think that I had confounded this notion with Mitscherlich's expansion of stone by heat, attributed by me to Babbage; but in fact Babbage's theory, which I had alluded to, was different, and in substance the same as yours, and I agreed with Murchison, that as Babbage was going to republish it in his 'Ninth Bridgewater,' it would be well to allow him to print, as he desired, both the extract from your first letter to me on the point, and your note to Murchison especially, as in both you had stated that you had not had time to reason out or state with minute accuracy the whole question. Whewell had both letters read at the Geological Society, which produced a most animated discussion in which Whewell took part. But now for another point. Babbage was very desirous that I would allow him to print another short extract from your letter to me. I objected at first, but he showed me that I need not be alarmed, because he introduced it as a counterpart of a passage from Bishop Butler, and that in such company no one could be otherwise than correct and orthodox.

I hope my willingness to be persuaded to have a passage printed, in which incidentally you had paid me a compliment (one which I certainly prized highly), has not led me to

what you would in any way think an indiscretion. Whewell, in his excellent treatise on the Inductive Sciences, appears to me to go nearly as far as to contemplate the possibility at least of the introduction of fresh species being governed by general laws.

Your volcanic speculations have at least set our wits to work, and will produce something.

I am very full of Darwin's new theory of Coral Islands, and have urged Whewell to make him read it at our next meeting. I must give up my volcanic crater theory for ever, though it costs me a pang at first, for it accounted for so much—the annular form, the central lagoon, the sudden rising of an isolated mountain in a deep sea, all went so well with the notion of submerged, crateriform, and conical volcanos, of the shape of South Shetland, and with an opening into which a ship could sail; and then we had volcanos inside some circular reefs, as in Dampier's island, and then we knew that it was not the corals which had any inclination of their own to build in a ring, like mushrooms and funguses in fairy circles on the green, for the very same species of corals will form a long barrier reef, or grow in any shape the ground permits: and then the fact that in the Pacific we had scarcely any rocks in the regions of coral islands, save two kinds, coral limestone and volcanic! Yet spite of all this, the whole theory is knocked on the head, and the annular shape and central lagoon have nothing to do with volcanos, nor even with a crateriform bottom. Perhaps Darwin told you when at the Cape what he considers the true cause? Let any mountain be submerged gradually, and coral grow in the sea in which it is sinking, and there will be a ring of coral, and finally only a lagoon in the centre. Why? For the same reason that a barrier reef of coral grows along certain coasts, Australia, &c. Coral islands are the last efforts of drowning continents to lift their heads above water. Regions of elevation and subsidence in the ocean may be traced by the state of the coral reefs. I hope a good abstract of this theory will soon be published. In the meantime, tell all sea-captains and other navigators to look to the facts which may test this new doctrine. I suppose that according to the above theory, if a volcanic

crater should sink, there would be two rings of coral, one on the rim of the crater, and one without.

May 26.—Since writing the above, Babbage has given me a copy of his 'Fragment' for you, so you will see how far we have published your letter.

At Babbage's yesterday, there was much talk of Wheatstone's new plan for telegraphing information by five wires conducting electricity, and carried through an india-rubber tube, or rather rope, each wire representing a letter of the alphabet, or several letters, I believe by different intensities of the charge. The wires isolated by the india-rubber. The experiment Mr. J. Taylor said had, according to Wheatstone, conveyed information through a rope five miles long, and of course instantaneously. These ropes it is said can be laid underground at small expense, under a railroad for instance, and news communicated with the speed of light.

Brewster is full of some new proof derived from the optical properties of the diamond in favour of its vegetable origin; some argument from anomaly or disagreement with any arrangement known to arise from mere mineral and inorganic structure.

Hoping that you and your family are quite well, believe me, dear Sir J. Herschel, yours ever faithfully,

CHARLES LYELL.

To HIS SISTER.

Copenhagen: June 13, 1837.

My dear Carry,—It is only a week to-day since we left London, and having already had two whole days with Dr. Beck, I feel as if I had been here an age. We went through Holstein from Hamburgh and its Danish suburb Altona, to Kiel, on a beautiful bay of the Baltic. In the morning we saw the sun rise in the principal Place, the Jungfernstieg, in Hamburgh, where the river Alster is dammed up so as to form a beautiful lake in the middle; in the evening we saw it set in the Baltic when Kiel was long out of sight.

We came to this capital on Sunday before sunset, and saw the beautiful harbour well. I was rather glad to find Prince Christian absent, in Funen, of which he is Governor, and Dr. Beck at leisure all day. We set to work at once at con-

chology and the Prince's Museum, and the critical examination of those points of recent and fossil conchology in which Dr. Beck and Deshayes are at variance, and on which some of my geological conclusions have been based.

June 21.—We were very glad to find on our table the day before yesterday your excellent journal. I was able to comply with a request of Mr. Loch's to introduce him to Prof. Wheatstone, and to get the latter to promise him a sight of the grand experiment about to be made of the electric telegraph. By-the-bye, have you heard of this wonderful invention? It has made a large figure in my waking dreams ever since I first heard of it at Babbage's, and I shall be disappointed if it fail to work a mighty change in the 'march of intellect,' at least of civilisation. I must tell you what I have seen. Wheatstone has had for a year at King's College, in the crypts, a copper wire with silk turned round it, four miles in length, carried backwards and forwards, and finds that he can transmit instantaneously through this distance a feeble current of electricity such as two plates, four inches diameter, of copper and zinc, can produce. Now you probably know that some fifteen years ago the famous Oersted, of this Copenhagen University, discovered that a current of common voltaic electricity caused the magnetic needle to move and place itself always at right angles to the current, so that you may move a needle at the end of the four miles of wire instantaneously, i.e. the current goes with the velocity of light, 200,000 miles in a second. Now you will ask whether it does not grow very feeble in passing four miles, and it does so, as it is always escaping; but then it only takes twice the power to send it four miles which it required for two, and it has long been known that if you coil the wire which has the electricity passing through it, say fifty times, this multiplies the effect on the needle by fifty. Now with four wires and four needles you can make sixty distinct signs, and so communicate any news by all the letters of the alphabet, instantaneously, any distance; and at all the intermediate places, coiled wires, called electrometers, being fixed to the main one which takes off but little of the force. It has been found that by employing small ropes steeped in india-rubber

gum, you may isolate the wires much cheaper than by silk, and thus each wire shall only cost between 3*l*. and 5*l*. per mile, or for the four wires under 20*l*. Now they had been obliged on the Birmingham and Liverpool railroad to use a very much more expensive telegraph, to give notice of trains coming to tunnels or places where they cross, by means of long iron tubes through which a blast of air is sent which blows a whistle at the end. So when this new rope with the four copper wires is substituted, we shall have not only railway news but all others sent out with the speed of lightning, ciphers being used for private confab. A few days after I left, a tarred rope was to be continued from the end of the four miles of wire, and thrown into the Thames, and then carried to the shot tower on the other side, and the rapidity of conveying intelligence through about five miles was to be tried. So perhaps a rope in the sea may carry news from Dublin to Holyhead, but at least under every railroad we can have it. After seeing the experiment for four miles of wire, I shall be surprised if it fails, and then it will be singular that as one revolution in human affairs was produced by observing how the earth's magnetism affected the needle or compass, so a second will follow the detection of the law by which common or voltaic electricity affects this same needle. But I did not mean to write so much London news from Copenhagen.

Your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Copenhagen: July 2, 1837.

My dear Eleanor,—I shall begin with telling you some of my Danish news which I think Mary is least likely to give you. Perhaps when you hear that I should like to stay here longer than I can afford to do, after our return from Christiania, you will wish to know what geology the streets here and this flat country of gravel and boulders afford me. This I can easily explain, as you have read my book, and know how much I have alluded in it to the comparison of fossil and living species of shells. In the time of Linnæus this city contained finer collections of

shells, and finer works were published here by Chemnitz (12 vols.), and others, than in any country of Europe. It is not wonderful, therefore, that even now some of the Danes should be far ahead, and that as Prince Christian had a taste for natural history, he should have a splendid private collection, and that the curator of his museum (containing above 8,000 species of living shells), Dr. Beck, should be one of the two or three best conchologists in the world. But besides this, Copenhagen possesses in its different museums most of the identical shells which Linnæus described in the editions of his 'Systema Naturæ,' published during his life; and here therefore alone, we can verify incontestably the species which he really described and named. As Lamarck and others have in very many cases mistaken the shells which Linnæus meant, great confusion has arisen, and it is here alone that this confusion can most readily be cleared up.

I am going over with Beck an examination of all the fossil species identified by Deshayes with living shells, and it will probably lead to many modifications of my views, at least of many of my details, also to many new views, which I shall perhaps have to test at Paris before I return. But my plans must be governed by circumstances not wholly in my power.

On Tuesday I went early to Sorgenfri with Beck, a fine morning, not too hot, and we discussed all the way points which had occupied us in the museum. He is an excellent botanist and entomologist. Soon after 8 o'clock we reached Sorgenfri, and after a walk in the flower garden, the Prince joined us. A landau and four nice horses was in waiting, and away we drove over a very fair macadamised road, through woods as wild and natural as any part of the New Forest, having at our left a remarkable chain of small lakes far below us; that is to say, we looked down a precipice covered with wood upon the lakes. We discussed the probable origin of the lakes, the Prince not forgetting here and there to stop the carriage and take me to points slightly elevated, where beautiful views are seen. In one of them we saw the towers of Copenhagen, about eight miles off to the south, and from another point the ancient Abbey Church of Roskilde. We then

passed between Lake Füre and a smaller lake to the village of Farum, and some miles beyond this, came to where the soil is composed to a great depth of innumerable rolled blocks of chalk with a few of granite intermixed. Fossils were very numerous in the chalk, and I hammered out many, and Beck found a finer fossil fish than had ever been found before in Denmark. Prince Christian set four men to work, while the horses were baiting, to clear away the talus and make a section for me, by which I saw that the boulders of chalk were in fact in beds, with occasional layers of sand between. A gamekeeper came to show an eagle which he had shot, a large osprey, I believe. I took two of his large quills, and mean some day to write a letter with it; of course it must be, as Count Blücher said, in a very lofty style. On our return to the opposite side of Lake Füre, which is twenty miles round, we drove down to the shore, and found a large sailing boat of the Prince's, and some men waiting for us. Before embarking, Beck and I collected a bottle full of shells inhabiting the borders of the lake, and I got some information which throws much light on the origin of the indusial limestone of Auvergne.

There was much wind, and we scudded about at the rate of ten miles an hour from one fishing ground to another, where everybody but I caught carp and pike. At least I learnt some ichthyology from Beck. We then found, at the further end of the lake, the carriage in attendance, with a second one to take such things as might have crowded us, and so we drove home. The Prince was very agreeable, and I was glad to find that his lady had been equally so to my princess, who has given you already an account of an entertainment on that and the following day, which was exceedingly amusing. I had no opportunity when here before of seeing more than that the princess was ladylike, handsome, and gracious; but from her conversation when alone with Mary, and during the walk with me from the boat in the evening, I am sure she is a very superior person, and one who has thought much, and formed her own opinions for herself on things and people, manners, religion, and politics. It was curious to see how much the Danes, both men and women, looked like English, and how much their accent resembles ours,

but the women, though almost fairer than the English, were not so handsome as in a fashionable party in London.

With love to all, believe me your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Copenhagen: July 29, 1837.

My dear Eleanor,—Mary has given you a diary of our proceedings up to our return to this place, and you will see that we were often separated when at Christiania, making independent expeditions. In my tour with Professor Keilhau to Hakkedal, we went about twenty-five miles north of Christiania, and I had a pretty good specimen of a Norwegian forest of fir-wood, and steep hills of granite, and other such rocks, with here and there a deserted iron or copper mine opened in the middle of the wilderness, and some *tractas* by which the woodmen draw out the fir trees which they fell, leaving enough to supply a natural growth in succession. The ground under the trees was often thickly covered with the *Linnæa borealis*. I was not aware that it smelt so sweet. On the marshy ground there was great abundance of the *Rubus chamæmorus*, which the natives call *moltk-bær*, which was red when I picked it, but which is yellow when ripe. We afterwards had some for dessert at Sörby. The Norwegians seem to prize it more than any of their wild fruits. They told me it had been much destroyed this year by the hard frosts, which continued during the nights even of the beginning of July this year, for, as in England, they had an unusually long winter. Even when we were there, though the weather was very hot, they said it was not equal to their usual summers. I heard the cuckoo in these woods. There were a great many farm houses scattered through those valleys where the granite was covered with clay, which, as a geologist, I must tell you is a marine deposit containing recent species of shells such as now inhabit the fiords of Norway, and as this clay rises sometimes more than 600 feet high, it fertilises a large district. There has been a good, brisk trade in wood of late years, which had thinned some of the forests we went through, but though

they do not sell as much as formerly, since we have favoured Canada by our duties, obliging ourselves to get dearer wood from thence, still a new market has opened in the north of France, where the French peasants are flooring their houses with wood, a new luxury to them. Upon the whole, all those we spoke with agree that Norway has increased wonderfully in prosperity since she was severed from Denmark, although the same natives are unanimous in extolling the Danes as a people above the Swedes. The fact is that Norway is extremely independent of Sweden, and pays nothing to it, and being no longer drained for the sake of Denmark, the Storthing has been able to diminish, and last year even to take off all the direct taxes, and they have put their money system on so good a footing, that their paper money is worth as much as the metallic, instead of being at a great discount, as in Sweden and Denmark. We were sorry, however, to hear some of the natural effects of a democratical system pushed so far as it is at present, so that the representation is virtually in the hands of the peasants or small yeomen, among whom almost all the land is divided in small lairdships. For example, the cathedral at Drontheim, said to be 800 years old, is falling into ruins, unless repaired, one of the finest monuments of the early days of Christianity in the North, but the Storthing will not vote a small sum for its repair. Several persons assured me that Mr. Laing, in his book on Norway, was unpardonably erroneous in what he says about the succession of land, for instead of a law like that of France, all the land goes now, and always did, to the eldest, and though he has to pay nominally a share in money to each of his brothers equal to his own, and half a brother's share to each sister, yet the customary mode of valuation has always been such as to give in fact a considerable *majorat*, and to keep properties as long in the same hands as in England. Norway was always too poor in the feudal times to be worth invading, so it was never conquered, nor shared out by a feudal lord amongst his vassals, as happened in other parts of Europe. On the other hand, the Danes supplied ministers, judges, governors, &c., who if they made fortunes, retired with them to Denmark, instead of founding great Norwegian families. Many substantial

small proprietors emigrate annually to the United States, chiefly to Illinois, near the Canadian lakes, and they are excellently fitted to settle there, in a better climate, cutting down the wood, and building houses like those in the mother country, and, as there, each having great resources in himself when far from neighbours. Upon the whole we liked much what we saw of the Norwegians, but I have no doubt they would be better off, and especially be more likely to remain permanently independent of Swedish influence, intrigue, and domination, if they had more than one single nobleman of fortune and independence like Count Wedel Jarlsberg, who is much liked and a very intelligent man, but with whom dies out the last remnant of Norsk nobility, the Storthing having provided by law that no other noble should be created. It is curious how many English and especially *Scotch* faces and figures one sees in the tall and fair men and women of Christiania. The rate at which they bowled us down the hills, exceedingly steep, without drags to the wheels, was such as I never witnessed elsewhere.

With love to all, believe me your affectionate brother,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

Wesel-on-the-Rhine: August 29, 1837.

My dear Darwin,—I write this to you, at least I am beginning it, in a steamboat on the Rhine, so make allowance for the tremulous motion. We came in a steamer from Copenhagen to Lübeck, then in a hired carriage to Hamburgh, across the sand and boulder formation of the Baltic, which for the most part we have been on ever since, although we have crossed the Weser, and Ems, and Lippe. The blocks of red syenitic granite, which I hammered away at in Norway, and which I saw there *in situ*, sending its veins into the trilobite and orthoceratite schist, have been carried with small gravel of the same, by ice of course, over the south of Norway, and thence down the south-west of Sweden, and all over Jutland and Holstein down to the Elbe, from whence they come to the Weser, and so to this or near this. But it is curious that about Münster and Osnabruck, the low

secondary mountains have stopped them; hills of chalk, Muschelkalk, old coal &c., which rise a few hundred feet in general above the great plain of north and north-west Germany, effectually arrest their passage.

This then was already dry land when Holstein, and all from the Baltic as far as Osnabruck or the Teutobarger Wald hills, was submerged. At Bremen I saw Olbers, aged seventy-two, the astronomer who discovered Pallas and Vesta, and there and at Osnabruck and Münster I met a warm and German reception from men of whom I had never heard, but who had read my paper on Sweden or something else. I mean by German, that kind of frank expression of enthusiasm for science, or of any emotion, which a well-bred Englishman tries to suppress, at least all outward expression of it, from the dread of being thought ridiculous, or of affecting to feel more than he does, or from *mauvaise honte*. If you ever get sick of that fashionable nonchalance which would blush to admire anything, or at least to confess it, I advise you to plunge into Germany, and you will be soon refreshed, and brought back to a right tone again, whether it be literature, science, or any other pursuit you are following.

I hope to write to Horner a full account of my surprise to find that there is no truth in overlying granite in Norway—no exception to the rule, as I will tell you presently—that he may read it at the British Association. Be it known then to you and others who have read what Von Buch wrote on Norway in the days of his youth, and of his Wernerianism and Neptunianism, that his notion of the granite overlying the transition rock arose from this, that whenever he found schist dipping towards granite regularly up to the point of contact, he assumed that it went under. The granite may lean over a little here and there, but this is accidental, and in general it sends veins only into the transition beds, changing the limestone into marble near the junction, and the shale into micaceous schist, and other metamorphosis, the fossils often escaping in the white marble, and some traces in some crystalline schists.

Now what I have seen in several places, I take Keilhau's word to be the universal fact. Had Von Buch believed as he afterwards did in the igneous origin of granite, he would

have found the veins, but without this, somehow or other, he came by false reasoning to the true conclusion, that the granite is newer than the Silurian beds. This is lucky for him. What struck me forcibly was this: after seeing proofs innumerable and beautifully clear of the order of age being first gneiss, then secondly, unconformable transition beds, then granite, and after seeing that the granite was the newest, I then found that the granite not only sent veins into both transition and gneiss, but actually sometimes passed by imperceptible gradation into gneiss. This gneiss, so ancient that it had been crystallised and then thrown into vertical and curved stratification even before the triloites flourished, this most ancient rock is so beautifully soldered on to the granite, so nicely threaded by veins large and small, or in other cases so shades into the granite, that had you not known the immense difference of age, you would be half staggered with the suspicion that all was made at one batch!

Paris, September 5.—Last year when Charlesworth spoke at Bristol about Crag, and the numerical percentage of recent tertiary shells, Sedgwick and Buckland gave some useful impromptu replies, stating that I was aware some modifications would be required, &c., but they would not affect this classification in the main. Now if he should again, as I expect, speak on this subject, and if he should again cite Beck, will you state that you happen to know from correspondence which you have had with me this summer, that I have been engaged with Dr. Beck in a careful examination of the species of fossil shells of the Crag and other tertiary formations which have been identified with recent species; that you have learnt from my letters that Dr. Beck by no means denies the absolute identity of a certain number of Crag species, though he thinks a large proportion of those identified by Deshayes to be distinguishable. Also that I consider that Dr. Beck's views of the conchological fauna of the Crag, drawn from the consideration of 260 species, tend to confirm the classification which places the Crag as older Pliocene and on a parallel with the Sub-Apennine beds, and distinct from and more modern than the Touraine, Bordeaux, and other Miocene deposits. Also, that I am convinced that independently of the relative percentage of recent shells,

about which naturalists may differ according to their notions of what constitutes a specific difference, there are other characters in the entire assemblage of forms of shells belonging to each great tertiary epoch, which will enable us to classify the deposits according to the approach which they make to the type of organisation now existing in the neighbouring seas; and that this approach will serve as a chronological test of the eras to which tertiary deposits may respectively belong. I mean the degree of approach to or departure from the assemblage of living shells in the neighbouring seas will be a test of the relative newness or antiquity of the several deposits; also that I consider the terms Eocene, Miocene, and Pliocene to be as convenient and (if I the inventor may say so) happy, in reference to this view, as when they were made to refer more exclusively to the proportion of fossil species identified with recent. For the Pliocene and Miocene will always express greater and less degrees of approximation to the existing fauna, and the Eocene that first dawn of resemblance which characterises the oldest tertiary shells when compared with those of the newest secondary formations. As I have not yet finished my examination of disputed points, and not even begun to hear the pleadings on one side, I will not risk any statement as to how far the identification of fossil with recent shells may have been pushed too far, for I certainly suspect that the error has been chiefly on this side; but I wish you to know that my conviction is stronger than ever, that rules may be given for measuring the approximation of different groups of tertiary shells, and that the degree of this approximation may be used as a test of age, and may lead to the same classification as that which I have adopted in the 'Principles.' I am fully prepared to defend all that is essential in my system of tertiary classification as founded on fossil shells.

Believe me ever most truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Paris: September 23, 1837.

My dear Horner,—I was glad to receive your report of the meeting at Liverpool, and to hear the Association was

so well supported. I must try to be at the next. I saw a very blundering account of my letter in the 'Athenæum.' I am anxious that when printed by the Association,[3] it should be given as I sent it, and this principally because I have carefully avoided bringing prominently forward any collision with Von Buch, whom I like too well not to be sorry that he should fancy, as he has done before now, that I am always seeking to run against him. I only mentioned him as having been the first to announce the posteriority of the granite to the transition beds, which was a grand step at that time, and true; though perhaps he did not come at it by a strictly logical course. I know how he drew his inferences, which were quite natural twenty-six years ago, before he had adopted the true theory of granite, but had I brought forward his errors, I should also have dwelt on his praises. Chancellor Brougham said of Serjeant Wilde, that it was rather hard to visit on the barrister the sins which he committed in the flesh as an attorney, and I should also think it hard to show up the mistakes which Von Buch the Huttonian fell into, in the youthful days of his Wernerianism.

With love to all, believe me yours most affectionately,

CHARLES LYELL.

To HIS SISTER.

Paris: September 23, 1837.

My dear Sophy,—We were glad to hear such a good account of the party at Kinnordy and your visitors in your last letter, and hope you still feel as if you could 'jump over the moon,' which we nearly do at our (or perhaps I should say my) mature age, at the thoughts of flying across the Channel once more after a longer absence than usual. We mean to steam it all the way, land and water, for the benefit of my fossil shells and our bones, not the fossil ones, and for the novelty of the thing, for both of us are heartily sick of the everlasting *pavé* between this and Calais. We go to St. Germain by steam carriage, by the Chemin-de-fer, which is advertised in a pamphlet beginning 'Paris vient de s'enrichir d'une *gloire nouvelle*,' and then by steamboat to Havre and

[3] British Association at Liverpool.

by another from thence to London. I have bought you a dozen small shuttlecocks, and went to the Quai Voltaire to ask for Grangier's Dante.[1] A complete copy had been sold a few weeks before for the very small price of fifteen francs, and I was told I should probably not get one, but Merlin on the Quai des Augustins might have it. Merlin had only one volume, 'Il Paradiso,' which I got, well thumbed, for four francs, and I took at a venture Montonnet's translation of the 'Inferno,' though Merlin said he believed it was not worth much; but it was only five francs, 1776. The same bibliopolist asked if I was going to London, 'because it was there that the French send for old French books, and there, if anywhere, Grangier might be bought entire.' *À propos* to the 'new glory' which Paris has gained, I have had a compliment to-day myself in the same style in a note presenting me a fossil shell. The donor, a stranger, tells me he had been requested to give duplicates away to geologists, and it was impossible for him 'd'adresser à une meilleure *illustration* géologique.' But a more delicate piece of flattery has been administered in my new passport. Even two years ago my 'nez petit' was changed to 'nez moyen,' but now it is 'nez long.'

After several days of heat, we have now so cool an evening that we have ordered a wood fire. The De Beaumonts, whom we mentioned last spring, have been calling, but we were out, as they were when we called. I mean Gustave and his wife (Mdlle. Lafayette); they sent a polite note of regret at missing us. They are only just returned two days. We had such a treat on Wednesday at the Théâtre Français; two best places in the balcon to hear Mdlle. Mars and Mdlle. Noblet in several pieces. The principal one, an old play, 'Le Jeu d'amour et du hasard.' Mdlle. Mars is not in the least gone off at sixty, and her voice very sweet, and looks like a pretty woman of thirty. Mary has had a pleasant letter from Lord Cockburn, who tells us that the new tower at Bonaly by Playfair is picturesque, and pronounced by Sir T. Lauder to be like the 'peel tower of a Border chief.'

[1] His father being desirous of obtaining every edition of Dante, of which he formed a fine collection.

Maison, on the Seine: September 24.—Here we are, after reaching St. Germain by railroad, and thence to this place by a fiacre over a road which we thought would have upset us. Certainly it was worth while paying some five francs extra to see the Parisians enjoying themselves on a *fête* day. It was a very gay scene. We had to wait three-quarters of an hour in a fine newly built *salle*, in which I suppose a thousand persons were waiting as if in a theatre, divided into compartments according to the price of tickets you had taken out. They made us take nine places, seven being for the luggage, which I am told was a great imposition, but I took only one-franc places. Though there was no cause for hurry, when the bell rang, there was such a bustle and rush, and the agent himself lost his head and was quite nervous. Fortunately, every one of the engineers as well as engines are English, and not one accident has happened, though as many as 10,000 a day have travelled for four weeks since it has been opened. To-day 17,000 have gone by it; allowing that a great many have gone both ways, perhaps some 10,000 persons. Our train contained 1,200 persons, each carriage forty, and many being filled with well-dressed ladies and beaux, was a very gay sight. It was twelve miles and a half, performed in about half an hour. Twice we crossed the Seine. The motion we thought pleasanter even than the Greenwich railroad. All nearly are travelling for pleasure; an exchange for the Montagnes Russes, Tivoli, or a jaunt to Versailles. The shareholders are quite surprised at their success and profits, and as the machines are tried and strained by the overweight, they have sent to England for more locomotives and more men. What a good thing for our own machinery-makers to supply the Continent! All the steamboats, I am told, in the Mediterranean, have English men and machinery, and so I found it in the Baltic and in Norway.

The Byrnes [5] came to the railroad to see us off, and just before we left our hotel, Clara Tourguenef (formerly Viaris) came to see Mary. She is a beautiful young woman, and very pleasant. The most singular part, perhaps, of the railroad sight was the length of way, several miles I should think out

[5] Uncle and aunt to Mrs. Lyell.

of Paris, of an unbroken line of lookers-on, on each side of the road to see the carriages pass.

Normandy: September 25.—We are on our way in a swift steamer which flies down the Seine at an average rate of fifteen miles an hour. Have passed Château Gaillard, built by Richard Cœur de Lion, and what interested me most, from historical recollections, Sully's country house, Rosny. It is a picturesque château, one side coming very close to the river, and all kept up in fine habitable order, having belonged to the Duchess of Berri lately. We fancied Sully walking on his favourite terrace. The scenery is always agreeable on this river, and sometimes striking, and our rapid pace gives it great variety. I have heard a discussion on Louis Philippe having married a son and daughter to Protestants, and being about to give two other daughters to Protestants—one to the Prince of Wurtemburg, the other to the reigning Duke of Saxe Coburg. This they say is popular with a large number of the Liberals in France, who, though Catholics, have been always fearing the return of the Jesuits, who were put down when Charles X. was banished. As far as a visitor can judge, Louis Philippe seems as quietly established on the throne as any king in Europe.

Havre: September 27.—We have to wait till the evening tide, having arrived last night at this port, now the Liverpool of France, and very flourishing. The Seine below Rouen, though not so beautiful and grand as above, was still very picturesque. The view back towards Rouen, some villages on the way to Honfleur, and the beautiful château of La Meillerie, where Mdlle. La Vallière was brought up, was an interesting object. We passed the old Castle of Robert le Diable, William the Conqueror's father. How full of antiquities Normandy is!

London: September 29.—We arrived last night, and found all well here.

With love. Believe me your affectionate brother,

CHARLES LYELL.

To His Father.

London: October 3, 1837.

My dear Father,—I send you three of the last medals which have been struck at the Mint of Paris, and which I hope you will add to your collection as memorials of the time of our last visit to that place. We went to see the triumphal arch of the Barrière de l'Etoile which is now finished, and has cost half a million sterling. I had no idea it was so colossal till we came up to it, and certainly it is very beautiful. Although the list of victories is too long to be marked on the medal, the first two which meet your eye on the side facing the Tuileries, are *Gemappe* and *Valmy*. I thought it almost ludicrous on the reverse of some of the medals of the arch to see two heads looking at each other, Napoleon and Louis Philippe, so I chose the one I send, though less characteristic of 1837.

As to the obelisk, you will see, I think, by the medal, that in itself it is a beautiful thing, but if I mistake not, you will wish it back in Egypt again when you see it. The fact is, hardly any monument could be placed where it stands, in the centre of the Place Louis XV., without being in the way. But this is, to my eyes, as out of place as a huge sphinx would have been just before Westminster Hall or Abbey. The first view I got of it was on entering the Tuileries Garden close to the Palace, and looking down the centre aisle, or rather avenue of wood, where the great fountain is at some distance. The end of this avenue, far off, should have been terminated simply by the great Arc de l'Etoile, and would have been so softened by the red light of the setting sun seen through it and round it. But one saw a black line much sharper than could be formed by any round column, standing before and cutting right in two, from top to bottom, this distant arch. Still worse, when you go to the Faubourg St. Honoré or Madeleine, and wish to look on the bridge at the front of the Chambre des Députés, you see the portico cut in two by the Theban intruder, and I imagine the effect must be equally fatal to the beautiful façade of the Madeleine itself when seen from the Chamber of Deputies.

We did not see the Musée de Versailles. Some told me

it was a 'grand collection of rubbish,' others that it was of great historical interest. I suspect it was one of Louis Philippe's good hits, of which I heard many. Among the rest Byrne told me this:—In Napoleon's time all the army became acquainted with the Emperor in the field; but Louis Philippe, seeing that he could never have this advantage in times of peace, changed the system of having certain regiments of guards always attached to the Palace, and had three at a time (each I believe is nearly 2,000 strong), to guard the Tuileries, of regiments of the line. They are changed after a year and a half or so, and all the officers dine in their turn as they mount guard, either with the King (those of higher rank) or with the Princes. He has already got through nearly two-thirds of the entire regular army, and they take pains to get personally acquainted with all the officers. I send the two shabby-looking old volumes of Dante I spoke of.

Believe me your affectionate son,

CHARLES LYELL.

To HIS FATHER.

London: October 21, 1837.

My dear Father,—As Mary is sending off a frank, I have been thinking whether our party on Thursday will afford any literary gossip worthy of being Boswellised, which I believe it would if my memory served me. I was amused with an anecdote of Calcott's, who said that some one was praising the waterfall at Bowood as by far the most beautiful artificial one in the world. Rogers, on being appealed to, asked if they would except Terni? When the Milmans were at Bowood the other day, one of Lord Lansdowne's horses ran away with Milman in sight of Mrs. Milman and his children; carried him under the trees, and then charged a high invisible fence of wire, which was thrown down, the poet rolling on the ground. But he was not stunned, and, being immediately bled, soon recovered. Mrs. Milman had time to be frightened terribly.

The subject of the bill for a general registration of mortgages, as in Scotland, was discussed, and declared to be only delayed by the attorneys. Milman cited some one who

said we were governed by three powers: the power of steam, the power of the press, and the power of attorney. Babbage, on our talking of what books might be stereotyped, said that a great part of his 'Economy of Manufactures' had been, but it would scarcely do for his Bridgewater treatise. Milman suggested that he might safely stereotype the blank chapter —a joke which Babbage took well. The question was started whether it was best for an author not to read the reviews against himself, as Sydney Smith declared was his system. Milman said it never answered, for when Sydney Smith was so cut up lately in the 'Quarterly Review' for his sermon on the Queen, he could not help trying to get from Milman what they had said of him.

Babbage had bound up in a volume all the violent attacks against him for his 'Bridgewater.'[6] Van de Weyer told us that he collected all the things which the Dutch wrote against him, and sent them to his mother, begging her to see what a son she had. One of these compared him to Robespierre, declaring the only difference to be 'that he (Van de Weyer) was the most bloody.' There was much joking from Van de Weyer and others about Sydney Smith having made the experiment last spring, in full season, of a trip to the Rhine, of which he got soon tired, and hastened back to London dinners and routs. Milman pronounced it to be a pure piece of coquetry, to try how they would miss him, though against his own rule, for he says 'that in London as in law, de non apparentibus et non existentibus eadem est lex.' We had much talk about Sir Walter Scott's Life, our summer tours, and so forth; but Mary has got her bonnet on, so I must conclude.

Believe me ever your affectionate son,

CHARLES LYELL.

P.S. Having a few minutes more, I must add an observation of Van de Weyer, that he knew many merchants whose families had had galleries of pictures (in Holland and Antwerp) for 200 years, and who added to them the best modern works of their artists. Babbage said that English merchants' families never outlasted two centuries. Milman said the

[6] The *Ninth Bridgewater Treatise*, by Charles Babbage.

reason is that here they are never stationary, and before two centuries go by they are above or below merchants—part of the aristocracy, or bankrupts, and forgotten.

To His Father.

London: November, 1837.

My dear Father,—Many thanks for your letter of congratulation on my birthday. I will begin by way of answer to put down a few recollections of an agreeable party which we had yesterday at the Milmans.'

A note from Sydney Smith excusing himself, with a joke even on the envelope. To Mrs. *Heart* Milman (instead of Hart) the seal having a ♡ on it with the motto. 'Il tuo nome non è la ventura,' if I caught the words rightly. Milman observed it was strange, for surely Sydney Smith could not have a premeditated joke purposely engraved on a seal. Presently Mr. and Mrs. Milman, Mr. and Mrs. Senior, Mr. Lockhart, Mr. Whewell, Mr. Rogers, Rev. W. Harness, Mr. Rich, M.P., and ourselves. When Mr. Rogers heard that Mary had been to Norway without seeing any waterfall, he said, 'That comes of having a man with a hammer for a fellow-traveller. What would you have thought when a girl, if a fortune-teller had predicted that you would marry a man who lived by his hammer? I was asking Lady Mary Fox (Rogers had just come from a visit to Colonel and Lady Mary Fox in Windsor Palace) what she would have thought if, when playing as a child in Bushey Park, she had been told that she would one day be a housekeeper; aye, and after your marriage, and such will be your situation that your friends will all congratulate you on getting the place of housekeeper.'

Rogers mentioned having known three persons who had known Pope. One was Lord Lyttelton, another a boatman who rowed Rogers over the Thames at Twickenham. 'Pray, as you have been here so long, did you know Mr. Pope?' 'Mr. Alexander Pope, you mean, sir; we called him Mr. Alexander Pope. Yes; when a boy I often rowed him over, I and my father, and he came to the river side in a sedan chair.' This led to much conversation about Pope, the subject having

first been brought on by Milman alluding to a new German book by one Waagen on paintings in Great Britain, in which Rogers' collection was praised, and an original clay bust or model by Roubilliac of Pope, I think. Whewell thought Pope by far the most influential literary man of his day. Lockhart thought that Dean Swift was superior, and, on our exclaiming at this, said that the Dean would have been too much for Pope had you met them together. Whewell rejoined that doubtless he would have been more than a match for Pope had they come to blows, but he (Whewell) was not thinking of a fight, but of mental qualities higher than he thought Swift possessed. Milman had been amused with an opinion of Goethe, showing his estimate of the relative dignity of poets and peers; he said, if Byron had spoken now and then in the House of Lords, his bad feelings would have found a vent, his spleen would have evaporated, to the great purification of his poetry. Whewell said, good-humouredly alluding to an attack on him by Brewster in a late 'Edinburgh Review,' that perhaps that was the meaning of the proposal to give peerages to scientific men, in which case science also might be purified of its grosser qualities.

Milman asked Mr. Rich (groom of the chambers to the Queen) whether it was true that the Queen had complained that they would not give her a diamond necklace. 'Not a word of truth in it, I assure you; she has several splendid diamond necklaces, but chose to wear a pearl one.'

Is it true that King Ernest has pressed for the restoration of the Hanoverian Crown jewels? 'Undoubtedly; they were joined to those of England at the union with Hanover, and ought, he says, to be separated again now that the crowns are disunited, but they are so mixed together they cannot tell which are which, and I suppose that the Queen thinks that the Salic law was never meant to apply to diamonds.' Senior remarked that she played her part remarkably well in the pageant the other day; that nature had intended her for such performances.

On Mr. Harness dwelling on the risk that a young person ran of being corrupted by flattery and power, Whewell said she would at any rate escape Henry VIII.'s trials, for he (Whewell) could see nothing in the spirit of the present times

which made him apprehend that Victoria would be corrupted by the possession of exaggerated power. Mr. Rich had been with her to the Theatre the night before, and said that her reception had been most enthusiastic. I asked him afterwards whether she had read much; he said, not much of works of imagination, none of Scott's novels, many of Miss Martineau's politico-economical tales! ! and she is now reading O'Driscol's 'History of Ireland.' When we were in the drawing-room I saw Mr. Whewell and Mary talking together, first, as I learnt afterwards, about Bonn, where he had been lately, and then about all the novels they had read, in which Rogers afterwards joined, showing a perfect recollection even of the tales written for children; Miss Edgeworth's 'Simple Susan' for example, to which Rogers objected that there never was a man so bad as Attorney Case, and said that in all her novels there were some characters overdrawn, in which Whewell would not agree. On Rogers joining Milman and me, we talked of Sir David Brewster's article in the 'Edinburgh Review' on Whewell, and Whewell's pamphlet in reply, and Rogers then remarked that such striking articles as that of Macaulay on Bacon did no good to the Review, but made the dulness of the rest more apparent; he regretted much in that article, and said Macaulay would repent having done anything to lower the name of a great teacher. I argued against Macaulay's view of the Utilitarianism of Bacon, and his comparing Bacon's inductive method to a simple piece of machinery like Aristotle's 'Logic.' Rogers said that even in the historical part, in which Macaulay was much stronger, he frequently sacrificed truth, because he had written for effect, and Bacon was not so bad as he had painted him. Milman complained that Seneca had been selected as representing the science of the ancients, and that even his 'Quæstiones Naturales' had not been mentioned, his best work in that line. They then expressed their admiration of the merits of the article, and among other eloquent passages Rogers repeated the following: 'It is a philosophy which never rests. Its law is progress; a point which was invisible yesterday is its goal to-day, and will be the starting-post to-morrow.' I have since thought of having this passage as a motto for my 'Elements of Geology.'

Talking of the popularity of Wordsworth's Poems, Senior asked Rogers if he thought Wordsworth had made fifteen thousand pounds. Rogers said he never made anything at all till last year, and then he received one thousand pounds for a new edition.

I was not sorry that Sydney Smith happened to be engaged, for though such a party would have drawn out some of his best fun, he would have overpowered Rogers with his boisterous laugh and sonorous voice, and it is a great pleasure to enjoy quietly some rays of Rogers' sunset; everything he says has a remarkably fine finish in it, but he is very mild and indulgent, and no remains of the epigrammatical sarcasm for which he seems to have been famous. I was amused with the abrupt ending of his confab in the drawing-room with Milman and me above mentioned. Milman's eldest boy came up, and, looking Rogers in the face, said, 'Mr. Rogers, do you like sugar?' There was a pause. I was thinking of the acidity formerly imputed to Rogers' conversation. Milman laughed, and Rogers said in an emphatic tone, 'Indeed I do,' and walked away to the tea-table.

I must not fill another sheet with discussions for and against Scott's partnership with Bannatyne (after Lockhart was gone); Mr. Trollope's new novel; Harriet Martineau's 'America,' and whether she was the plainest woman in the world, or almost handsome, especially on her first return from the New World.

Believe me, with love to all at Kinnordy,

Your affectionate son,

CHARLES LYELL.

CHAPTER XXII.

JANUARY 1838–OCTOBER 1841.

'ELEMENTS OF GEOLOGY'—SEDGWICK'S LECTURE—WHEWELL'S 'INDUCTIVE SCIENCES'—ANNIVERSARY AT THE GEOLOGICAL SOCIETY—DARWIN ON VOLCANIC PHENOMENA—VISIT TO NORWICH AND YARMOUTH—NEWCASTLE MEETING—DARWIN'S JOURNAL—CORAL REEFS—ATHENÆUM CLUB—DR. FITTON'S REVIEW—HUTTON'S CLAIMS—BRITISH ASSOCIATION, BIRMINGHAM—VISIT TO SIR ROBERT PEEL—TRAVELLING IN UNITED STATES—RAPID GROWTH OF THE COUNTRY—NIAGARA GEOLOGY.

To Professor Sedgwick.

January 20, 1838.

My dear Sedgwick,—I have been very busy since my return from Denmark with my 'Elements of Geology,' which I hope to get out before the summer, and have just finished abstracting from Murchison's sheets, which I have read with no small pleasure, a short account of the Silurian rocks and their fossils. I am now upon your Cambrians, and as I give a few woodcuts of fossils in each group I should have liked to give a few of the earliest ones if possible. Phillips, in his new treatise in Lardner, has given us a few Snowdonian fossils of his own collecting in 1836, and I would of course select others, that I might not interfere with his, and might give as much as possible original information to the public. I should, however, be content if there were any figures published of what you consider true Cambrian organic remains of any order of animals, to copy them in my small reduced woodcuts, just to give novices an idea of the generic forms, if I can do no more. I believe there are some specimens, from Snowdon and elsewhere, of Cambrian fossils in the Geological Society's Museum, but if you can put me in the way of furnishing a page of woodcut figures, it will be doing me a great service.

Our cousin Miss Winthrop[1] gave us an account of your second lecture, and of your manner of controverting one of my theories, with which I was well satisfied. But when Sir W. Parish put into my hands the report of the same lecture in the 'Norfolk Chronicle' of January 13, I confess I was out of patience with the reporter. He makes you say, 'Various false theories have been adopted by *infidel* naturalists,' &c. He goes on, 'One of these,' &c., one sentence; then 'another was Lamarck's theory,' three sentences; then 'Mr. Lyell's theory, that the creation of new species is going on at the present day, was also condemned as rash and unphilosophical.' Had I not known more about the lecture and about you, I should have thought that I had been classed with the infidels. Now touching my opinion, I have no right to object, as I really entertain it, to your controverting it; at the same time you will see, on reading my chapter on the subject, that I have studiously avoided laying the doctrine down dogmatically as capable of proof. I have admitted that we have only data for *extinction*, and I have left it rather to be inferred instead of enunciating it even as my opinion, that the place of lost species is filled up (as it was of old) from time to time by new species. I have only ventured to say, that had new mammalia come in, we could hardly have hoped to verify the fact. Indeed, if I were asked, where is your new mammiferous species, which has filled up the great vacancy caused by so many removals? I might perhaps say, this is just my strongest case, for there is *man*, a mammifer of yesterday, which has been spreading by millions over the globe. But I certainly wish it to be inferred from my book, that in the ocean, beyond the sphere of man's interference, and in the desert, and in the wilderness, and among the infusoria and insects, the extinction has been going on in the last 6,000 years, and that the substitution of species to supply the vacancies, which must always be occurring, has also been going on; though *how*, is a point we are as ignorant of as of the manner of God's creating the first man. You will, I hope, allow that to assume that there have been no new creations since man appeared, is at least as 'rash and unphilosophical,' as modestly to hint

[1] Now Mrs. C. Baring Young.

the possibility of such occurrences, which is all you will find I have done. Whewell, I think, has put this well in his 'Inductive Sciences.' He has brought up the subject of extinction and new creations to that point which science has reached, or where our *present* ignorance begins, without discouraging those investigations which may lead to our discovering what laws may still govern this mysterious part of nature's operations, the coming in of new beings. To me it appears that the line you are represented to have taken is to hazard a far bolder hypothesis than I should have dared to do, viz. that no new creatures have begun to exist for the last 6,000 years, or for such time as man has existed, although geology has now brought to light the proofs of an indefinite series of antecedent changes, such repeated failures of species of animals and plants, and their replacement by others. The burden of proof rests on him who ventures to affirm that Nature has, at length, stopped short in her operations, and that while the causes of destruction are in full activity, even where man cannot interfere, she has suspended her powers of repair and renovation.

Believe me ever most truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

London: February 24, 1838.

My dear Horner,—Mary is going to send you a journal, but, as she did not attend the anniversary,[2] I will send you a short account of that meeting. Not so full as usual, and most of the M.P.s absent on the Irish Poor Law question; nevertheless, a grand display of talent. Whewell in the chair, Sedgwick, Buckland, Sir P. Egerton, Darwin, Owen (who is wonderfully pleased at receiving the Wollaston medal), Fitton, Greenough, Hallam, Milman, Murchison, Lord Burlington, Prof. Jones, Lubbock, Bayley, Clift, Hamilton, and on the whole the great horseshoe table tolerably well filled. A short time before the meeting, Whewell told me that I should have nothing to do, unless I would propose the

[2] Of the Geological Society.

President, which as ex-President fell naturally to me. So I began the speaking, and said it would be impossible for them to appreciate Whewell's services in the chair, unless I reminded them in what an eventful year of his career as author and scientific workman he had rendered those services. I therefore enumerated his doings in the year, beginning with three volumes on the Inductive Sciences. I mentioned that on my return from Norway and Denmark, I mentioned to Lodge, fellow of Cambridge, how good a companion Whewell's last work had been to me, but soon found myself at cross purposes, as he had to tell me of *two* other works published since my absence, viz. the 'Mechanical Euclid,' which had already come to a second edition, and secondly, the 'Studies of the University of Cambridge.' On my return home, I found his paper (eighth series), 'Experiments and Observations on the Tides' in 'Philosophical Transactions,' for which the Royal Society soon after gave him the royal medal. On my expressing to my friend Mr. Jones (who sat opposite me) my wonder that Mr. Whewell, entering so much into literary and scientific society, could possibly, with all his Cambridge professional duties, find time even to pass through the press so much matter, supposing he did not write a word, what was my astonishment when Prof. Jones told me that his friend Whewell, then staying with him in town, was actually then passing through the press *four other works*, viz. two new editions in different forms of his 'Bridgewater Treatise,' and thirdly, a long article in the 'Medical Gazette,' on Physiology of Nerves of Sensation and Volition, relatively to the Bell and Mayo controversy and claims, and fourthly those four sermons preached at Cambridge in November last, which I had read with much pleasure, in which he has treated of Butler's and Paley's views of morals, moral philosophy, &c. There may be other writings, and certainly a controversial letter to the 'Edinburgh Review;' but I asked, if these alone were considered, not as the monument of one year, but of a lifetime, would it not be thought sufficient for the zeal and industry of one man, and yet in this year Whewell had made an efficient President of the Geological Society? I would not dwell on that labour of love, the eloquent address they had heard the opening of that morning, but his sacrifices

in attending our meetings, and the time given to details of management, of getting a new secretary and other internal rearrangements of the Society's official business, for doing this in so busy a year, called for their acknowledgments. This address was well received, and Whewell replied modestly, fearing that most of them would think when they heard of so many works, that he had done too much to do any well. In proposing Owen, he put very well his being a fellow townsman and schoolfellow of his own. In proposing the different Societies, he made a beautiful allusion to Terence, saying, 'I am a man; homo sum, humani nihil a me alienum puto,' and parodied it well, 'We are geologists, and we regard nothing in physics and natural history as foreign to our purpose.' Sedgwick was uncommonly splendid in replying for Cambridge, and pointing out the connection between abstract science cultivated there, and all general reasoning on particular facts, geological and others; such reasoning alone raised us above the dregs of matter, &c. Whewell drank the 'Strangers,' and Prof. Jones last, who made a truly eloquent speech, and very extemporaneous, on the similarity of the prospects of the two new sciences, different as they are in their subjects, geology and political economy. After the anniversary evening, Lord Cole pressed me so hard to go and eat pterodactyl (alias woodcock) pie at his rooms, that I went, with Whewell, Buckland, Owen, Clift, Egerton, Broderip, Hamilton, Major Clerk, Lord Adair; and there we were till two o'clock, fines inflicted of bumpers of cognac on all who talked any 'ology.' Cigar smoke so strong as half to turn one's stomach. I lost the enjoyment of Murchison's dinner next day, and for five days only did half a day's work or less. It is a serious warning to me how careful I must be.

Yours affectionately,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

London: March 12, 1838.

My dear Horner,—At the last meeting of the Geological Society, Darwin read a paper on the Connection of Volcanic Phenomena, and Elevation of Mountain Chains, in support of

my heretical doctrines; he opened upon De la Bêche, Phillips, and others (for Greenough was absent) his whole battery of the earthquakes and volcanos of the Andes, and argued that spaces at least a thousand miles long were simultaneously subject to earthquakes and volcanic eruptions, and that the elevation of the Pampas, Patagonia, &c., all depended on a common cause; also that the greater the contortions of strata in a mountain chain, the smaller must have been each separate and individual movement of that long series which was necessary to upheave the chain. Had they been more violent, he contended that the subterraneous fluid matter would have gushed out and overflowed, and the strata would have been blown up and annihilated. He therefore introduces a cooling of one small underground injection, and then the pumping in of other lava, or porphyry, or granite, into the previously consolidated and first-formed mass of igneous rock. When he had done his description of the reiterated strokes of his volcanic pump, De la Bêche gave us a long oration about the impossibility of strata in the Alps, &c., remaining flexible for such a time as they must have done, if they were to be tilted, convoluted, or overturned by gradual or small shoves. He never, however, explained his theory of original flexibility, and therefore I am as unable as ever to comprehend why flexibility is a quality so limited in time. Phillips then got up and pronounced a panegyric upon the 'Principles of Geology,' and although he still differed, thought the actual cause doctrine had been so well put, that it had advanced the science and formed a date or era, and that for centuries the two opposite doctrines would divide geologists, some contending for greater pristine forces, others satisfied like Lyell and Darwin with the same intensity as nature now employs. Fitton quizzed Phillips a little for the warmth of his eulogy, saying that he and others who had Mr. Lyell always with them, were in the habit of admiring and quarrelling with him every day, as one might do with a sister or cousin whom one would only kiss and embrace fervently after a long absence. This seemed to be Mr. Phillips' case, coming up occasionally from the provinces. Fitton then finished this drollery by charging me with not having

done justice to Hutton, who he said was for gradual elevation.

I replied, that most of the critics had attacked me for overrating Hutton, and that Playfair understood him as I did. Whewell concluded by considering Hopkins' mathematical calculations, to which Darwin had often referred. He also said that we ought not to try and make out what Hutton would have taught and thought, if he had known the facts which we now know. I was much struck with the different tone in which my gradual causes was treated by all, even including De la Bêche, from that which they experienced in the same room four years ago, when Buckland, De la Bêche (?), Sedgwick, Whewell, and some others treated them with as much ridicule as was consistent with politeness in my presence. Yours affectionately,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Kinnordy : September 1, 1838.

My dear Horner,—This our second day at Kinnordy has been, they tell us, the most like summer of any they have had this year. The place looks beautiful, and I have at last some leisure to give you an account of our British Association Meeting at Newcastle. Mary, however, has just come into the library, and reminded me that I must begin further back, and go to the banks of the Yare, from which she sent her last journal. I ascertained during my tour in Suffolk and Norfolk two points respecting the Crag, which I had never made out before, at least to my own satisfaction. First, that the mammalia, such as mastodon, elephant, &c., were really coeval with the true Crag shells. Secondly, that the Crag of Norfolk was not, as some have supposed, of a newer date than that of Suffolk. This and several other minor points, besides the acquisition of specimens of shells, would have satisfied me, even if I had not met with certain vertical lines of flint, or paramondra, which supplied me with the materials of a small notice which I read at Newcastle, and of which you will see a good abstract by-and-by in the 'Athenæum.'

We avoided all but collectors at Norwich; but on the last day there (Sunday), we went to the Cathedral, where the Bishop spied us out from his throne, and sent the verger to ask Mary and me to come to the Palace to luncheon, which we did, and saw Mrs. and Miss Stanley, and walked round the garden. We had to hurry away, as we had to set off in the Yarmouth steamer at three, and had a pretty sail down the river. The day after (Monday) I took a long walk with Mr. Pellew along the sea-shore. We went by steam from Yarmouth to Hull, and thence, after sleeping a night, in another steamer to North Shields, where we landed at six o'clock in the morning, and so perfectly refreshed by our night in the steamboat, that we both enjoyed a good long expedition along the shore to Tynemouth, walking, and then in a gig to a point on the coast, Cullercoats, where the ninety-fathom dike is laid open in the cliffs, the magnesian limestone on one side and the coal on the other. I then went to see another fine section of the same dike, or rather fault, cut open by a railway about a mile inland, and the quarries of magnesian limestone and marl slate in which the fossil fish are found. Next day we crossed the Tyne to South Shields and visited the Marston Rocks, where there are lofty perpendicular cliffs of magnesian limestone, and small isolated rocks or needles of the same in the sea. The coast scenery was very grand, and the brecciated form of the magnesian limestone, which is an aggregate of angular masses of itself, as if broken up and reconsolidated *in situ*. The same evening we got to Newcastle. As soon as I saw Murchison, he told me it was arranged that I should be President of the Geological Section, which was immediately confirmed at the meeting of the general committee. The other Presidents were Herschel, Physical; Babbage, Mechanical: Whewell, Chemical; Sykes, Statistical; Sir W. Jardine, Zoological; Dr. Headlam, Medical. Our section was crowded, from 1,000 to 1,500 persons always present; Sedgwick, Buckland, Daubeny, De la Bêche, Greenough, Phillips, Griffiths, Sir P. Egerton, Owen, and many other good men taking part. Portlock and Torrie my secretaries.

All that I saw of the government of the Association gave me a good idea of the spirit, but no wish to consume my time

in taking a part in it, to which I am invited, I hear, by being put on the council. Sedgwick was so eloquent; his lecture to 3,000 people on the sea-shore made a great impression.

Ever affectionately yours,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

Kinnordy: September 6, 1838.

My dear Darwin,—I must first read your letter again which I answered in a great hurry at Newcastle. I should like to have a talk over Salisbury Craigs with you, especially on the spot. I do hope some day that we shall be able to examine together some of the volcanic rocks on the coast near the Red Head, within a day's ride of this place. It is a splendid exhibition, and I think we should make out several points of eruption and sections of the feeders of the old volcanic islands of the Old Red Sandstone period. The variety of porphyries and amygdaloids is quite splendid. I assure you my father is quite enthusiastic about your journal, which he is reading, and he agrees with me that it would have had a great sale if separately published. The other day he told me that he wished to get a copy bound the moment it was out, and send it as a present to Sir William Hooker, who more than any one would be delighted with yours. He was disappointed at hearing that it was to be fettered by the other volumes, for although he should equally buy it, he feared so many of the public would be checked from doing so. I hope you mean to sell a portion of those copies which I think you told me you were to have separate, as I think it was a large number.

When do you think the book on Coral Reefs and Volcanos will be out? In recasting the 'Principles,' I have thrown the chapter on De Beaumont's contemporaneous elevation of parallel mountain chains into one of the Preliminary Essays, where I am arguing against the supposition that nature was formerly parsimonious of time and prodigal of violence. You will, I am sure, find the discussion of that question much more naturally placed by this new arrangement. I should like to know, when you next write to me,

how far you consider your gradual risings and sinkings of the spaces occupied by coralline and volcanic islands in the Pacific as leaning in favour of the doctrine that many parallel lines of upheaval or depression are formed contemporaneously. If I remember right, some of your lines are by no means parallel to others, although many are so. In one point of view, your grand discovery proves, I think, in the most striking manner, the weight of my principal objection to the argument of De Beaumont. You remember that I denied that he had proved that the Pyrenees were elevated after the cretaceous period, although it is true that the chalk has been carried up to their summits, and lies in inclined beds upon their flanks; for who shall say that the movement was not going on during the cretaceous period? Now in your lines of elevation, there will doubtless be coralline limestone carried upwards, belonging to the same period as the present, so far as the species of corals are concerned. Similar reefs are now growing to those which are upraised, or are rising.

September 8.—Many thanks for the 'Spectator' which came this morning. I really find, when bringing up my Preliminary Essays in 'Principles' to the science of the present day, so far as I know it, that the great outline, and even most of the details, stand so uninjured, and in many cases they are so much strengthened by new discoveries, especially by yours, that we may begin to hope that the great principles there insisted on will stand the test of new discoveries. I am pleased to think of the improved form in which this part of the work will come before the French for the first time. You hope that the 'Elements' may send many to the 'Principles,' but I am not yet so sanguine as to be free from apprehension lest they should stand in the way of the 'Principles.' This, however, cannot be known yet.

I am very glad to hear you like the Athenæum. I used to make one mistake when first I went there. When anxious to push on with my book, after a 'two hours' spell,' I went there by way of a lounge, and instead of that, worked my head very hard, being excited by meeting with clever people, who would often talk to me, very much to my profit, on the very subject on which I was writing, or I fell in with a Re-

view or Magazine relating to geology. Now this was all very well, but I used to forget that this ought to count for work although nothing had been written, and that I ought consequently to give up my second 'two hours' spell.' By not doing so I was often brought to a dead stop, so that at last, for fear even of meeting with anybody in the streets who would also talk geology, I was sometimes driven for a walk into Gray's Inn Gardens. But then you will say comes the difficulty, how to avoid theorising, for nothing substantial is gained by dwelling on the subject when there is no pen, ink, or paper before one. After lying two hours fallow the mind is refreshed, and then in five minutes your fancy will frame speculations which it will take you the two hours to realise on paper. As your eyes are strong, you can afford to read the light articles and newspaper gossip, which I could never indulge in much with impunity.

My father has been more and more taken up and delighted with your journal, and begged me this morning to invite you to come here any day this or the next month, when we shall be here, for as long or short a time as you like. Steamboats every Wednesday to Dundee, passage from thirty-six to forty hours; railroad four times a day from Dundee to Glamis, where the carriage meets you, and brings you in half an hour to Kinnordy—an easy trip for one who was never sea-sick except in sailing vessels. Do come, if you want some fresh air, and if you choose to bring MS. here and write, as I do whenever I choose, four or five hours quietly every day, I promise you the means of doing so; or if you prefer a geological excursion, remember that an autumn on this East coast may be almost always reckoned upon for fine weather.

Will you be so good, after reading the enclosed note to Dr. Richardson, to send it post-paid to him? I was glad to see him at Newcastle. Do not let Broderip, or the 'Times,' or the 'Age,' or 'John Bull,' nor any papers, whether of saints or sinners, induce you to join in running down the British Association. I do not mean to insinuate that you ever did so, but I have myself often seen its faults in a strong light, and am aware of what may be urged against philosophers turning public orators, &c. But I am convinced, although

it is not the way I love to spend my own time, that in this country no importance is attached to any body of men who do not make occasional demonstrations of their strength in public meetings. It is a country where, as Tom Moore justly complained, a most exaggerated importance is attached to the faculty of thinking on your legs, and where, as Dan O'Connell well knows, nothing is to be got in the way of homage or influence, or even a fair share of power, without agitation. The local committee at Newcastle were quite amused at the eager press for tickets, after the meeting began, on the part of those who had most sneered against the whole thing down to a few weeks before its commencement. I can also assure you, as the strongest commendation, that the illiberal party cannot conceal their dislike, and in some degree their fear, of the growing strength of the Association, in which circumstance as geologists we are particularly interested. We must take care not to hint this last argument to the Tories, many of whom are helping forward the cause gallantly at present, and, Heaven be praised, we seemed in no danger of splitting on the rock of politics, which I always fear much more than any occasional squabbles amongst ourselves, which can never come to anything like lasting feuds in a body collected from so many different quarters. The moral of all this is, Go next year to Birmingham if you can, although your adviser has been only to two out of eight meetings. Did you really manage to drink nothing but water at old Jones'?

Pray write and gossip at full when lounging at the Athenæum to me, and never imagine you can say enough.

As to the Glen Roy case, I saw, in Orust in Sweden, great beds of stratified gravel and sand like those which cover our Scotch hypogene rocks entirely destitute of shells; yet there were beds of shells like those of Uddevalla, and sea beaches at still higher levels. Mind I tell you about the absence of shells in some of my Norwegian Newer Pliocene beds.

Believe me, my dear Darwin, ever most truly yours,

CHARLES LYELL.

To Dr. Fitton.

Kinnordy: August 1, 1839.

My dear Dr. Fitton,—Although we are not far north of Edinburgh, your review only reached my father's house last night, and I have this morning read it through without stopping, and with very great pleasure and profit, for it contains much that is new to me, as well as much that is gratifying. Indeed I suspect you must have left out those passages of an 'excoriating' character which you hinted at when we last met, or must have thought me one of the most sensitive of authors. I have certainly reason to be more than satisfied, for it is a piece of good fortune which happens to few even once in their lives, to be criticised by a reviewer who has read and thought over all they have written, as well as what others have done and said, and to still fewer who have that luck, to come off with so much praise. I am very glad that you have dwelt so clearly, in your ample analysis of my 'Elements,' on those points in which it differs from the 'Principles.' I do not remember a single point in which I think you have misunderstood me, geologically speaking. The first note I think of a slight mistake is where you ascribe to Scrope a section which is my own of the lava of the Coupe d'Aysac. I made it on the spot, and to the best of my recollection you will find nothing like it in Scrope, whose work is not at hand. But I have borrowed so many illustrations from Scrope (though not, I trust, either in his or any other case, without acknowledgment), that I am the last who should grudge him the appropriation of one of mine.

I am pleased to see you have been able to draw out Lonsdale's just claims to original views in regard to the Devonian and other subjects, and assert for him what he will never do for himself. Your application of the lines 'The times have been,' is admirable, and the whole article runs off fluently and in entertaining style, and varied until you get into your elaborate disquisition on Hutton, which to all the general readers, and to many of the initiated, will, I fear, be somewhat heavy. It has been useful to me, as I found it difficult to read and remember Hutton, and though I tried,

I doubt whether I ever fairly read more than half his writings, and skimmed the rest. Considering at how late a period, as compared to Steno, Hook, Leibnitz, and Mora, he came into the field, and consequently how much greater were his opportunities, I think his knowledge and his original views were confined to too small a range of the vast science of geology, to entitle him to such marked and almost exclusive pre-eminence as you contend for in his behalf. If you had not felt some natural indignation at the unpardonable neglect with which the French and Germans have treated him, you would not, I think, on reading downwards from the theories of the older writers, have considered his merits on the whole as so transcendant. Your citation (immediately following the woodcut) is a more perfect enunciation of the gradual acquisition of the metamorphic character by successive modification than I had remembered to exist in his writings.

I remember on one occasion Boué, in reference to my citations of Macculloch, apologised for having pretended to such complete originality in regard to the change of strata by Plutonic action, and Von Buch told me on my citing Playfair for the elevation of Sweden, that neither he nor any German had had access to Hutton's and Playfair's works during the war, &c. I feel, however, by no means disposed to defend the Continental writers from your charge, and you might have included Macculloch, who so ably filled up Hutton's rough sketch of the metamorphic theory, but with scanty reference as usual to the merits of a great predecessor.

In distinctly alleging that my defective appreciation of Hutton's claims was the ground of the pages which you write in his defence and eulogy, a point again enforced in the last sentence, you should have been careful to distinguish between the total neglect of Cuvier, Von Buch, Humboldt, Boué, Brongniart, and others, and the inadequate rank in the relative scale which in your judgment I have assigned, as the simple reader of your review must confound me with all the rest. As you do not complain that my historical sketch was disproportionate in length to the general plan of my 'Principles,' I must assume that you think Hutton occupies too small a space; yet in my first chapter I gave Hutton credit for first separating geology from other sciences, and declaring

it to have no concern with the origin of things, and after rapidly discussing a great number of celebrated writers, I pause to give, comparatively speaking, full-length portraits of Werner and Hutton, giving to the latter the decided palm of theoretical excellence, and alluding to the two grand points in which he advanced the science. First, the igneous origin of granite, secondly that the so-called primitive rocks were altered strata. I dwelt emphatically on the complete revolution brought about by his new views respecting granite, and entered fully on Playfair's illustrations and defence of Hutton, and he is again put prominently forward in the 'Elements,' where no other but Lehman and Werner are mentioned. The mottos of my first two volumes were especially selected from Playfair's Huttonian Theory, because although I was brought round slowly, against some of my early prejudices, to adopt Playfair's doctrines to the full extent, I was desirous to acknowledge his and Hutton's priority, and I have a letter of Basil Hall's in which after speaking of points in which Hutton approached nearer to my doctrines than his father, Sir James Hall, he comments on the manner in which my very title-page did homage to the Huttonians, and complimented me for thus disavowing all pretensions to be the originator of the theory of the adequacy of modern causes.

Yet, to how many of your readers, who will never see my work, will your elaborate advocacy of Hutton seem to imply that I overlooked, or have been unwilling to acknowledge even in a moderate degree, his just pretensions! It was my business, in tracing the progress of our science to its present state, to estimate the importance of each writer, and adjust the quantity of space due to him in my historical sketch, not simply according to his originality and genius, but partly at least in proportion to his influence; and I still think that Werner's eloquence, popularity, enthusiasm, and position at Freyberg, placed him in this point of view as much above Hutton as I have represented him to fall below him in reference to the truth of his theories. Yet as an admirer of Hutton all I could have wished is, that your panegyric on Hutton had appeared as aiding and seconding my efforts,

since I trust that no book has made the claims of Hutton better known on the Continent of late years than mine.

As the 'Edinburgh Review' has been so long in noticing any of my writings, it is really a great point to have at last been honoured by so very long an article, though I doubt not I have lost much by Napier's cashiering. But I have no more room to thank you now for having taken so much pains to write what I regard, in spite of the Huttonian episode, so very favourable a critique on my productions.

With our joint remembrances to Mrs. Fitton,

Believe me ever most sincerely yours,

CHARLES LYELL.

To HIS SISTER.

Dudmaston: September 1, 1839.

My dear Sophy,—After the business of the Section (at the British Association at Birmingham) on Tuesday in which I took a part, as you will see by the 'Athenæum,' a party of us set off by railway to Tamworth, to go twenty-seven miles before reaching Sir Robert Peel's, whereas the direct road is only fourteen north of Birmingham. We first went about fifteen miles on the road to Coventry, and then turning off on a new railway lately opened to Derby, we were taken to Tamworth, where three of Sir Robert's carriages were in attendance to convey us and our bags about three miles to his place, which we reached after eight o'clock, having been rather more than two hours on the road. When in motion we went always at the rate of twenty-two miles per hour, but time had been lost in starting, and when we turned off from the great London road, we had to wait sixteen minutes to see whether there were any passengers in the train from London booked for Derby. During this stop we had a fine view of the great luggage train, in which there were no passengers, but forty-eight waggons laden with baggage covered with canvas. It seemed of interminable length, was preceded by two locomotives, and passed us at full speed, having to keep clear of a train only ten minutes behind it. To prevent this train from running into it, the last carriage contained a huge red lamp which looked like a

conflagration. It was a marvellous sight to see it shoot by. At Tamworth there is a fine viaduct, and Tamworth Castle is a fine and very ancient building. We found Lady Peel in the drawing-room, who is tall, handsome, and ladylike, but rather grave. Sir Robert received us very pleasantly, and we should have sat down soon after eight if Whewell had been dressed, but it was nearly nine before the dinner began. Whewell and Lord Northampton sat on each side of Lady Peel, Murchison, Mr. Lloyd, son of the Principal of Dublin University, Comte de Cambour, a French mathematician, who has published the best work on the theory of steam engines, Fox Talbot (photogenic), John Taylor, Treasurer of British Association, Mr. Yates, Honorary Secretary of ditto, Major Sabine, late Mathematical Secretary to the Royal Society, and myself. I sat on Sir Robert's right hand, and during a conversation of three hours we talked of a great variety of subjects; antiquities of Tamworth, railways, paintings, sculpture, chartists of Kirriemuir, Birmingham, &c., British Association, bearing of geology on Scripture, Wordsworth's Poems, Chantrey's busts. Some of the party said next day that Peel never gave an opinion for or against any point from extra caution, but I really thought that he expressed himself as freely, even on subjects bordering on the political, as a well-bred man could do when talking with another with whose opinions he was unacquainted. He was very curious to know what Vernon Harcourt had said on the connection of religion and science. I told him of it and my own ideas, and in the middle of my strictures on the Dean of York's pamphlet I exclaimed, 'By-the-bye, I have only just remembered that he is your brother-in-law.' He said, 'Yes, he is a clever man and a good writer, but if men will not read any one book written by scientific men on such a subject, they must take the consequences.' After he had explained to me how railways were taxed, I pointed out to him Lord Carnegie's proof that such a method acted as a bonus towards the imposition of high fares. This he saw, and admitted as an evil. If I had not known Sir Robert's extensive acquirements, I should only have thought him an intelligent, well-informed country gentleman, not slow, but without any quickness, free from that kind of party feeling which prevents men from fairly

appreciating those who differ from them, taking pleasure in improvements, without enthusiasm, not capable of joining in a hearty laugh at a good joke, but cheerful, and not preventing Lord Northampton, Whewell, and others from making merry. He is without a tincture of science, and interested in it only so far as knowing its importance in the arts and as a subject with which a large body of persons of talent are occupied. He told me he was one of the early members of the British Association, and that he was glad that we had persevered in holding our meeting at Birmingham under discouraging circumstances; yet I learnt afterwards from the Birmingham Committee of Management, that when some of them, being personal friends of Sir Robert, asked his opinion only three weeks before, he could not venture any opinion at all. Being pressed to come in to the grand dinner on Thursday, he said he was so unpopular in Birmingham that he would only be an element of discord where all was harmony as far as the British Association was concerned. His refusal was a disappointment to the leading members of the British Association and to his political friends in Birmingham, where he would have been well received. There are many beautiful pictures and statues, of which he was very happy to give us a full account. He pressed us most politely not to hurry back to our business next morning, but to stay and breakfast with the family, which some did; but most of us returned early, and I was reading a paper at eleven o'clock, but I contrived besides breakfasting to see the garden, which, although not a fine one, pleased me from having each kind of flower in large masses. In the dining-room is a single picture by Haydon of Napoleon in St. Helena. It was very striking. Sir Robert told me that there is an ode on it by Wordsworth which is given in the 'Quarterly Review' in a late article on Waagen's Tour in England. It represents Napoleon with his back turned towards you, looking from a height on the boundless ocean. Among the pieces of sculpture are some remarkable statues by Gibson of Liverpool? artist. But the most striking is a bust which Roubilliac made for Lord Bolingbroke. Chantrey made Sir Robert a present of his own bust of Sir Walter Scott as a pendant for this. I might meet Sir Robert

Peel in society and visit him for years without having as much talk with him as from having thus by accident sat next him for three hours. He is looking in wonderfully better health and spirits than when I met him at the Royal Society with Sir H. Davy ten years or more ago. He is much taken up with his boys, and had been showing Liverpool to them.

Ever affectionately yours,

CHARLES LYELL.

To CHARLES BABBAGE, ESQ.

London: August 11, 1840.

Dear Babbage,—I send you two guidebooks for the steam trip on the Seine, and you will not be whirled by the geology, and old Sully's château and Cœur de Lion's Castle, &c., as we were, at fifteen miles an hour. Pray read the accompanying geological notes, and inquire about that strange coating of salt, and write to me about it. Address to Hart Street from Paris, for I am writing on it, and would give much to be able to go and hammer with you at those fine old inland sea-cliffs. I wish you could land and send me notes enough for a joint paper on the subject. The salt at Andelys was liberally laid on the surface. As I once saw a raised beach with recent marine shells thirty feet high near the base of the cliff under the lighthouse at Cap la Hève, there has been an elevation there in geologically modern times, but still perhaps twenty thousand years ago, and that cannot explain the inland cliffs having their incrustation of salt. But bear in mind how little would make the valley of the Seine once more a deep bay bounded by chalk cliffs. As I only found out the salt when I got home, I unluckily cannot say whether any part of the 'roches d'Orival' (the first, I believe, which you will see of the grand old cliffs) has a saline incrustation. The surface is decomposing these and pulverising.

Ever faithfully yours,

CHARLES LYELL.

[In the autumn of 1841, Mr. Lyell paid his first visit to the United States, and lectured at the Lowell Institution, Boston. He was thirteen months absent, and made tours in Canada and Nova Scotia.]

To LEONARD HORNER, ESQ.

Lockport [near Niagara]: August 26, 1841.

My dear Horner,—I am much obliged to you for your news of the British Association at Devonport, and the Geological Society Section, and glad that Phillips has come out with his Devonian fossils. Mr. James Hall, State Geologist of New York, who is now travelling with me, wishes much to have the book. I have been getting up the details of their Silurian system with great pleasure, comparing the supposed ancient boundaries of Lake Ontario, when it was 150 feet higher, with its present shore, the phenomena of drift and erratics, and other features of the geology here, with which as well as with their working scientific men I have been much pleased. The signs everywhere of rapid progress and sudden conversion of the wilderness into a region covered with populous cities and communicating with each other by railways, canals, and river steamboats, which go through still waters at the rate of fifteen miles an hour, is quite exhilarating to me. I was warned by an English officer not to be misled by so dazzling a spectacle, for that so much was due to borrowed capital, and has ended and will end in countless bankruptcies. But the real wealth of this country in cities, steamboats, &c., must soon, like its population, equal that of the land from which it draws so much borrowed money. Colonel Coulson told me in the 'Acadia,' that he and other officers could not help being annoyed in Canada, at witnessing the superior rate at which each new American city founded on the shores of the great lakes, surpassed in a few years in population, wealth, steamers, churches, and buildings, its British neighbour, enjoying all the same natural advantages. I remember asking Mr. Mallet,[3] who rarely fails to clear up my difficulties in political economy, to explain this, and he admitted that although the French Seigneuries, and other remains of feudal tenures, as well as a colder climate, would account for some part of the contrast, yet it would not do for large tracts in Upper Canada. Colonel Coulson told me, that when he expressed wonder during the rebellion, that land sold so high on the borders, he was

[3] John Lewis Mallet, Esq., son of the celebrated Mallet du Pan, for many years Secretary of the Audit Board.

answered by a purchaser, that should Canada change hands, its selling price would immediately be doubled. I think I have found a complete explanation of this enigma.

The population in the United States is now increasing in the enormous ratio of 800,000 a year, of which about 100,000 only come from Europe. The great movement of colonisation westward is supplied mainly by New Englanders, all, whether *Locofocos* (Radicals) or Whigs (that is Conservatives), devotedly attached to their own institutions, and mostly anti-slavery politicians.

An estate in Ohio is worth double one of equally good land across the river in Kentucky, because the New Englanders will not colonise the slave state. So will they avoid British or foreign institutions in Canada, and people densely inferior land on their own side the border.

There is not so much drought here as farther east. Among the trees we are much struck with a fir tree called a hemlock, and with several kinds of walnuts, such as the butternut and hickory, and various kinds of oaks, and the sugar maple. I have seen one tree frog, and last night heard several catydids or grasshoppers, which croak as loud as frogs. There is a yellow flower—a *solidago*, which is as vulgar a weed as our Scotch weebow,[4] but to my eyes more elegant; a knotweed, which looks just like ours, is most abundant. Heaths are unknown, so is furze, and we miss our wee crimson-tipped daisy. The wild roses are past, but we have seen a few. We do not meet with many people of colour so far north, but without being an anti-abolitionist, I am sometimes half inclined to believe, that when the geological time arrives according to the system of progressive development for a being as much transcending the white man in intellect as the Caucasian race excels the chimpanzee, he will be puzzled in his work on natural history, when he comes to the order Primates, and has to decide whether the projecting os calcis and elongated ulna, and the more moderate share of intellectual endowment, must not force him to admit of two species, in spite of the innumerable crosses which we meet with here at every step.

Believe me ever your affectionate son-in-law,

CHARLES LYELL.

[4] Senecio Jacobæa.

To LEONARD HORNER, ESQ.

Albany: September 21, 1841.

My dear Horner,—Mary has mentioned how much I was pleased with the Blossburg coal-field, which is the only formation except Silurian, Old Red, and Post Pliocene, that I have yet seen. Its analogy in fossils, white quartzose sandstones, bituminous shales, carbonate of iron, &c., with English coal-fields, is truly surprising. Dr. Saynisch[5] was an excellent guide. When Prince Maximilian of Neuwied was here, he travelled with him to the prairies, and the genuine descendants of John Bull were very intrusive in their desire to see a Prince, and used to march in without ceremony and ask the Doctor whether they could see the Prince. 'Yes, if you will pay twenty-five cents.' 'Nay, but I wish to see him.' Upon which the good-natured Max came out and said, 'Here I am,' and they went away disappointed to see a shortish man, in ordinary attire, instead of a magnificent hero in purple and gold. Dr. Saynisch practises gratuitously on the homœopathic system, and we saw him measure out some powders of infinitesimal quantities to a tall stout miner, adding injunctions about diet, in which I suspect lay the real force of the panacea. He likes the people, but told me some anecdotes in explanation of his not being in love with their institutions. He came with a strong predilection for the democratic party, but says they have cured him, not by homœopathic, but allopathic doses. He says it is the same with most German Liberals whom he knows. I have just been calling on the Governor of this State—his Excellency Mr. Seward—and expected to see a man of venerable age, but found him, as I do almost all men who are in active employment in this stirring country, a good deal younger than myself. He said he had already written to me, and he heard me very attentively on the subject of the Survey, and the best manner of getting out the final report with illustrations. General Dix, formerly Secretary of State, and originator of the Geological Survey, called on me, a gentlemanlike man of my own age, and talked on the same subject. I was glad to tell him how well I thought upon the whole

[5] President of the mine.

the plan had worked, especially in creating a set of practical and scientific hammer-bearers. You see in many books on the United States that the people are very good humoured and full of jokes. The fact seems to be, that the great throng of them are from fifteen to twenty years younger than those you meet with playing the same active part in Europe. Yesterday, as I stood in the bar-room of a wayside tavern, on our return from Scholarie, the young proprietor of a large pedlar's waggon marches up to the bar-keeper and says, 'Can we have dinner?' 'Yes, for how many?' 'Eight remarkably handsome young men.' 'Very well; in ten minutes.' All day this sort of thing goes on as a matter of course between perfect strangers.

I am very glad to hear that you have a geological paper on trap dikes on the stocks; the width of some dikes in Connecticut, and the manner in which they turned from intrusive walls into intercalated and nearly horizontal sheets, has interested me much, but the subdivisions of their Silurian system have chiefly occupied me.

Philadelphia: September 27.—Here I am, working away in quarries of greensand, and picking up belemnites and other cretaceous fossils, with Conrad for my guide, whom I am happy to find quite at my service, and the best-informed paleontologist on this side the Atlantic.

You probably never heard of the Helderberg war, but as it was the great talk while we were geologising among the hills of that name in Albany County, New York, I must inform all you who live out of the world, that this is now the third year's campaign. When old Van Renssalær died, the last nobleman in the United States, his vast landed estate was divided among three sons. A population of about 40,000 inhabited the share which fell to the eldest, who endeavoured to get regular payment of his rent, besides arrears, which his indulgent predecessor had allowed to accumulate. Now the payment of rent being most unusual in the United States, where every man farms his own land, or what he calls his own, for it is often deeply mortgaged, was voted quite an abuse of the old feudal times. They thought they had paid long enough, and said with some truth, that they had cleared a wilderness and created the

property themselves. So they would pay nothing. The laird appealed to the Sheriff, but they laughed at law processes, and at constables, till finally the Sheriff asked for troops from the Governor, who called on the Volunteers, who, as with us, proved, however constitutional a force, to be a most unfit one to interfere with temper and discipline. The farmers and peasantry turned out, erected barricades, and mounted some brass cannons, and have set the Government for three years at defiance, not one farthing of rent paid the while, and a party disguised as Indians maltreated a constable while we were there, and it was feared for a time that he was murdered. It is allowed that the landlord has mismanaged matters, and been far too uncompromising, but I must say, that after what the New Yorkers did in the Canada War, and since in Macleod's affair, I think there is a want either of energy in those who should enforce law, or of respect for it in the minds of the majority.[6]

With my love to all, believe me yours affectionately,

CHARLES LYELL.

To DR. MANTELL.

Boston: October 29, 1841.

My dear Mantell,—I was glad to hear of you from Dr. Silliman, who has probably told you of a visit which we paid to him and his very agreeable family at Newhaven. After staying two days with them we went by New York and the Hudson to Albany, where I began my explorings in the Silurian strata, and from thence I examined the valley of the Mohawk, in company with Mr. James Hall, who has been employed by the Government with four others, to survey the State of New York, which is about the size of our island. The Falls of Niagara were as beautiful as I expected, perhaps scarcely so grand, but in geological interest far beyond my most sanguine hopes. As I shall send a paper on the proofs of their recession to the Geological Society, I will not dwell on them now. After spending some time there, I examined seriatim all the Silurian groups in the Old Red and Coal on the borders of Pennsylvania. Returning to Albany

[6] See *Travels in North America*, by Charles Lyell, vol. i. p. 68.

I went south to Philadelphia, and spent four days in collecting in the different divisions of the Green sand in New Jersey, having Conrad as my guide. The analogy of the genera, and even of the species to the European chalk, is most striking. I went with Dr. Harlan [7] to see the great skeleton brought by a German, Koch, from the Missouri; a very large Mastodon which he calls the Missourium. He has turned the wonderfully huge tusks the wrong way—horizontally—has made the first pair of ribs into clavicles, and has intercalated several spurious dorsal and caudal vertebræ, and has placed the toe-bones wrong, to prove, what he really believes, that it was web-footed. I think he is a mixture of an enthusiast and an impostor, but more of the former, and amusingly ignorant. His mode of advertising is a thousand dollars reward for any one who will prove that the bones of his Missourium are made of wood. He is soon to take them to London, when you will have a great treat, and see a larger femur than that of the Iguanodon. Harlan is lost in admiration at the bones of this and other individuals, all belonging to the old Ohio Mastodon of Cuvier, from very young to very old individuals. He has also other fossils. Of my tour into the anthracite regions of Pennsylvania you will hear the results when the paper I sent Fitton on the Stigmaria clays is read. I like the people here very much, and have a most attentive class of about 2,000 both at my morning and evening lectures.

My lectures here will take me four weeks more, and my plan is then to run away from the winter so far south as to enable me to keep the field, examining especially the cretaceous and tertiary formations, and not to go northwards till the spring has fairly opened this fine country.

Believe me, my dear Mantell, ever most truly yours,

CHARLES LYELL.

[7] An eminent osteologist; died in 1843.

CHAPTER XXIII.

JUNE 1842–DECEMBER 1843.

NIAGARA—NOVA SCOTIA—SUBTERRANEAN FOREST—UNFAIR STATEMENTS ON THE UNITED STATES—RETURN TO ENGLAND—CONTEMPLATES WRITING A JOURNAL OF HIS IMPRESSIONS OF AMERICA—MUCH GEOLOGICAL WORK IN PROSPECT—GIANT'S CAUSEWAY—LORD ROSSE'S TELESCOPE—PRESCOTT'S 'MEXICO.'

CORRESPONDENCE.

To LEONARD HORNER, ESQ.

Lewiston, Canada: June 13, 1842.

My dear Horner,—We have come to this place from the Great Falls to-day, having by the way enjoyed some excursions to the top and foot of the great precipice which bounds the river, and I have found some additional evidence of value to my mind, in favour of the recession of the Falls, having traced the freshwater formation three miles and a half down on the summit of the cliff, the old river bed. I was occupied a week in active exploration of the Niagara district, and understood it much better. The raised beaches of Lake Erie are more difficult to explain than the Niagara ravine, and I hope in descending the St. Lawrence to get some new lights on these matters. To-morrow we sail for Toronto. I shall now look back a little into my journal. The contrast of the disturbed and bent Coal, Devonian, and Silurian in the Alleghanies, with the vast expanse of horizontal beds of the same formations west of the immediate base of those mountains as far as we went in Ohio and borders of Kentucky, is very interesting, and the magnitude of the coal-fields is prodigious. The new aspect worn by the same subdivisions of the rocks below the coal in Ohio, as compared with what

I had previously seen of the same in New York, was very instructive. I continue to be struck with the general analogy of American and European geology, as regards the fossiliferous groups, which surprises me, it seems so much greater than between North and South Europe. I shall have a great stock of communications to make to the Geological Society on my return. We have been having remarkably cool weather at Niagara. There was even ice two nights during our stay there, but this was favourable to health and work. It has a strange effect when you have succeeded in obtaining some view of the Falls in which nothing appears but sky, wood, and water, and, when you are listening to the sound of the Falls, to be suddenly wakened out of your reverie by the loud whistle of a locomotive drawing a load of tourists and of merchants trafficking between the east and west, who discuss the Falls in three hours between two trains. Goat Island is the most perfect fairyland that I know. The views of the two Falls from it, and of the rapids which surround it, are delightful, and in the walks through its natural and aboriginal forest, you catch no view of the houses and mills which rise in the village on the United States side, bearing the ominous name of Manchester, and which may, I fear, ere ten years are past, extend some of its factories into the beautiful island. We purchased, on coming away, a dagnerreotype of the Falls, and I think you will be surprised to see how well the sun has overcome the difficulty of the moving waters. What would I give for a daguerreotype of the scene as it was 4,000, and again 40,000 years ago! even four centuries would have been very important.

I am glad to have seen Ohio, as the finest example of rapid colonisation on record. The passage of manufactured goods and of the plough was at first from the Ohio northwards; but no sooner were steamers introduced into the lakes, than wealth and emigrants were landed on the northern shore from Lake Erie, and the central forests are now alone uncleared. It is supposed it might easily support a population equal to that of England and Scotland, but the movement westward prevents the filling up after the first occupation. The annual addition of people now made to the United States is just equal to that of the most flourishing State, Massa-

chusetts, exceeding 700,000, of which a small part, only a seventh I am told, comes from Europe. It is a curious fact, with which Mr. Ticknor surprised Lord Holland some years ago, that the number of white persons now living in the United States exceeds the total number of all who have been buried in the United States from the landing of the Pilgrim Fathers, and this may probably be true fifty years hence. I leave you to work out the enigma. So long as the Pennsylvanian Germans and settlers coming from the Rhine predominated in Ohio, no money could be obtained for public education, nor for roads; but the moment the New Englanders had the majority, a liberal tax for these purposes was assessed. About a fifth of the whole population of Ohio is said to speak German, but a much greater number are of German origin. We found at Columbus, in the centre of the State and the seat of Legislature, that there was a church with a congregation of 300 to whom sermons are preached in the Welsh language. In the Legislature of New Orleans, I learn that speeches are made indifferently in French and English. Is it not singular that the whole body of German farmers, all proprietors of land, those anti-innovation men, who would vote nothing for any improvements, are the most ultra democrats, or rather they are blind tools in the hands of demagogues? One principle avowed by their leaders is, that schools and colleges naturally breed aristocrats, and they therefore seize every opportunity of permanently voting away those lands and funds which were originally set apart by the central government for popular and university education. In various other States the same mischief has been done, and a war waged against all corporation property and State lands. In Georgia they have lately put the whole State lands into a lottery, and every one drew for prizes, and they could not give the usual grant to the Medical College at Augusta. If some of the State debts are repudiated, it will be the fruit of universal suffrage, for they might all pay easily if they would tax themselves moderately. Although I have been too busy with geology to have learnt much in proportion to our tour respecting the politics and institutions of the United States, I am already surprised at the little that is known in England about matters here, where

there is so much worth imitating as well as avoiding. Part of Ohio is called the Indian Reservation, and it is singular that there is more wild game there than anywhere else, for they will let no wild animals be disturbed except they want them. You often see written up on the high road 'Mover's House,' an empty wood building, in which emigrants may pass the night. Another common inscription is 'Cash Store,' which does not mean a bank, but that you cannot buy in that shop for barter. The terms bakery and book-bindery seem useful Teutonicisms. They have many mules in Ohio, which I heard commended for their longevity, an advantage I never thought of before. Ask Darwin if he is aware of the hybrid having borrowed a portion of the ass's length of days. What a perfectly intermediate creature!

Kingston, Upper Canada: *January* 19.—In looking over part of this letter I see some inconsistency, and you might ask how could the annulling of universal suffrage bring matters right in Ohio, if nearly half the landed proprietors are most ultra democrats. The fact is, that had the votes of the low Irish and German Catholic emigrants who can vote after five years, by a law which was an innovation on the original charter of Washington and his colleagues; had these votes of the merest breakers of stone and hewers of wood been cancelled at the last election, the returns would have been entirely opposite, as these uneducated new-comers, except a minority of Protestants, all go *en masse* with the demagogues; yet in spite of this and other evils, I have not been in any country, where, if I was so unfortunate as to live out of my own, I could so well settle as in the United States; even in Ohio, as at Cincinnati. You would find ample sympathy among the vast mass of more intelligent Americans in your disapproval of all the more glaring faults in their institutions; nine-tenths of those with whom we are thrown feel keenly the disgrace of any repudiation of State debts, and had the New Englanders been left to people the new States, without the influx of the dregs of Europe, bringing with them violent anti-aristocratic and Chartist feelings, great want of education, Irish sectarian Catholicism, and other prejudices, their credit would now I believe have stood as high as it does in the New England

States, where they are so thriving, in spite of universal suffrage. When once Americans see that you have a thorough respect for them and their country, they at once throw aside their optimism. For example, on my remarking to a merchant of Cincinnati that their Presidential elections gave rise to so much intrigue, bribery, and corruption, as to reconcile any one to monarchy where it was established, 'You are right, sir, and our Presidents have more power in the way of patronage and vetos than your kings ever had. The worst pages in English history are the wars of a disputed succession, but ours is one continued civil war of the same kind, and if the contending parties do not kill each other in the body, they do all they can with bribes and threats to do injury to their morals and principles.' You and I would hear more in good society here (in Canada) in one week, which we should consider narrow-minded and prejudiced and ungenerous to foreigners, in matters of politics, religion, and political economy, than we heard in nine months in the United States, for they have here all the Kleinstädterei of a colony and the enmity of the borderer, added to everything that you might disapprove of which they bring from home. They know very little of the United States, and do not wish to know more; but of course there are many exceptions, and allowance must be made for the abominable interference of the uncontrolled American mobs in the late rebellion here, where the United States sympathisers brought cannon from the State arsenals, and the collision of the violent democratic party, of those born and bred in the new clearings, with the aristocratic feelings of capitalists and officials who come straight from Europe. But I must conclude, and with love to all,

Believe me ever most affectionately yours,

CHARLES LYELL.

To HIS SISTER.

Truro, Nova Scotia: July 30, 1842.

My dear Marianne,—We have just returned from an expedition of three days to the Strait which divides Nova Scotia from New Brunswick, whither I went to see a forest of fossil coal-trees—the most wonderful phenomenon perhaps

that I have seen, so upright do the trees stand, or so perpendicular to the strata, in the ever-wasting cliffs, every year a new crop being brought into view, as the violent tides of the Bay of Fundy, and the intense frost of the winters here, combine to destroy, undermine, and sweep away the old one—trees twenty-five feet high, and some have been seen of forty feet, piercing the beds of sandstone and terminating downwards in the same beds, usually coal. This subterranean forest exceeds in extent and *quantity* of *timber* all that have been discovered in Europe put together. The new deposit of red mud of the numerous estuaries here affords me endless instruction. At this place, Truro, the tide is said to rise seventy-five feet. So we see the bottom of a deep salt-water sea, its rippled sands, shells, the holes of *Mya* and *Tellina* and their tracks, footmarks of birds and worms, the manner in which the clays crack and are marked by rain, and sometimes shells enclosed recently in solid nodules of claystone. I have also learnt more about the *geological* effects of drifting ice in the last ten days than in all the Canadian tour. The people here are quite loyal and monarchical, but their manners just as in the States. Mr. Lowell remarked to me one day, that nothing so much surprises the American readers of the 'Quarterly Review' as to see so much which they know to be purely the result of circumstances, not political in the United States, attributed exclusively to the difference of their institutions from ours. There is so strong a conservative party among the rich and literary class in the United States, that the constant bitterness of the 'Quarterly Review,' 'Blackwood,' and other journals on the same side, and newspapers, against their country, which they resent from patriotic feelings, works precisely in the way which an ultra democrat, and still more a person opposed to an established church, would wish. When one reflects in how short a time, a time which even the present generation will live to see, the population of the United States will exceed ours, how short-sighted is all this! for the ideas of the United States must soon react much more powerfully on the English part of the Old World than they have done yet.

We have seen a great many woods, in which the low *Kalmia angustifolia* in flower purpled the ground almost as

much as the large heath in Hampshire, and reminded us of the entire absence of heaths. The variety of wood here is very great, but the trees not so large. The quantity of birch and fir is the most novel feature. The quantity of rich marsh land gained from the sea forms the chief wealth of the region we have seen. You can no more let land here than in the United States, for anyone may obtain acres of his own nearly as cheap. This circumstance alone, besides the absence of any hereditary aristocracy, and a well-endowed established church, would assimilate this or any other genuine English colony to one of the States of the Union.

Your affectionate brother,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

Kinnordy: October 12, 1842.

My dear Mr. Ticknor,—When I wrote a few words to you last week I was busy with the preparation of my paper on the Niagara district. On reconsidering my journal, I find a good many subjects of general interest to the naturalist as well as to the geologist, which would not easily enter into any of the twelve or more distinct subjects, such as Niagara, fossil Mastodons, Alleghany Coal, Nova Scotia Coal, Martha's Vineyard, &c., some of which have been, and others are to be, read at our Geological Society, abstracts appearing in their proceedings.

It struck me that in a journal of my tour a place could be found for these matters, and a few of my impressions of the country and people, omitting names of persons, except my scientific fellow-labourers, and generally all things not scientific. On making notes this last week, for this journal, or 'personal narrative,' I soon found that there would be danger of its growing to a book, which, as I gave all my thoughts in the United States to my own science, would do me no credit, though a bookseller would prefer it to the scientific ballast which might be overcome by the specific levity of the first part of the performance, and so float up the vessel. Yet, I cannot bear not to take the opportunity, not only of telling my scientific friends what route I took,

and how long I tarried, that they may test my opportunities of observation—but also of saying how I liked and what I thought of the people and country, as I ran through it on the railway, or the deck of the steamer. It may be said in a few words, thought I; so I made a few notes of my voyage and tour to Niagara, Blossburg, and Boston, with quotations from my journal, on the exhilarating effect of viewing the signs of such rapid progress in population, and the railways, churches, and school-houses among the stumps, &c. But I know by experience the remark which this would provoke here. 'It is very easy to go ahead with other people's money.' The answer is, that all the States of New England and New York, traversed in that first excursion, have either no debts, or have paid the interest of their debts, or have made railways with their own money, and their credit in trying times has stood high; yet their form of government is as popular as anywhere. But I must not shirk the 'Helderberg War,' but allude honestly to the only shady side of the picture forced on my sight in the first six weeks.

The New York people admitted it was a disgrace, just as we do when in Ireland the sheriff and soldiers fail year after year in distraining for rent, and ejectments are defied by the physical force of a mob, and are often permanently defeated. There are only two or three other difficult points which have yet struck me as requiring to be entered into, in order that I may not be addressed by the critics in the words with which Lord Lovelace met me soon after I came back: 'So, Lyell, I understand you have returned ipsis Americanis Americanior!'

First, as to Repudiation: your letter on Sydney Smith only expressed what persons of opposite parties, and all whom we lived with, had said. As to gambling speculations, not guaranteed by States, they are like our bubbles of 1826, our late Australian bankruptcies, &c.; but the suspension of interest by Pennsylvania and other States, I attribute to universal suffrage and the votes of aliens. But I may add the similar extension of franchise would immediately cause the non-payment of the interest of our debt; therefore, the wonder is that with these institutions any States pay, and that the Central Government can still borrow. It seems to imply a higher standard of education or morality, or less

poverty. I would enter on this subject *à propos* to the great distress I witnessed in Philadelphia, partly from the alarm of the stoppage of the State dividends, partly the United States bank. On this side of the water the sufferers think that Brother Jonathan has come off a winner by their losses, and they are surprised and softened when I tell them how great has been the calamity on the other side of the Atlantic. Perhaps I may say that, in proportion to the small capital which the Americans have to invest permanently for incomes, the ruin was as severe with them as with us. But then comes the hardest task of all—the Southern States. No part of my tour was more agreeable and instructive, geologically, than that south of the Potomac, and it has much changed my feelings towards the planters, however much I may think of slavery as I did before. The domestic and farm slaves whom we saw were a cheerful, often merry and light-hearted set; childlike, conceited, boastful, but not a suffering class, when compared with what may be witnessed in Europe, and at home. They are uneducated, and not in the way of being improved or raised in station. I had them often with me for days, and neither saw nor heard of ill-treatment. It is anything but an economical system, unless where rice-grounds, sugar, or cotton, and crops which I did not see, may make it desirable to have an animal that can stand the climate. The evils to the whites are innumerable. If poor, there is no place for them; if rich, they have to submit to the indolence and inefficiency of their slaves, to doctor them when ill, support them when bedridden, guard against their being excited by Abolitionists, &c. Their children are corrupted by them, being made vain by flattery, spoilt by power. If I give the favourable part of such a picture, and enumerate the difficulty and danger of attempting any reform, because convinced that foreign and American interference has been hitherto injudicious, I might throw my mite into the wrong scale. When with the planters, seeing their kindness to the slaves, and feeling that had I inherited their estates, I should not well know what to do; I could not but feel that a London emancipation meeting, or a list of advertisements by Dickens, raked out of newspapers from all parts, would irritate and indispose me to exert myself

in forwarding the cause of emancipation. Sydney Smith said to me one day: 'But you should hold up the system to the reprobation of mankind.' I replied that it must be a work of time, sacrifices must be made, and the philanthropists ought to share them with the planters. Then comes the objection that an indemnity to purchase the liberty of all the slaves would exceed the means of the whole Union. This only proves that the Abolitionists ought to have confined their efforts within practicable limits. Might they not have begun attending to a few northern slave States, most ripe for a change to the better? As to our English meddling, it is like repeal meetings in America; and Lord Lansdowne said very well, when Lord Ashley's *exposé* of the collieries was made, they had better have been looking nearer home than speechifying about the miseries of the American blacks. A candid anti-slavery philanthropist from England in the midst of a black population, and asked by a planter what he would do if his British ancestors had bequeathed to him such an inheritance, would generally, I suspect, feel taken aback.

Perhaps by this time you are beginning to feel the same sort of surprise and alarm about my journal that I might feel were I to receive by next post a letter from you, announcing a project of a work on the literature, arts, and manners of Spain, Italy, &c., with your first impressions on the *geology* of those countries. But I beg you to consider that I am now setting before you all the most doubtful and difficult topics, which will only come in incidentally, if at all, in the journal devoted chiefly to remarks and speculations on natural history and science.

When they are placed in their niches in a large building, they will shrink, I hope, into their due proportions, or may be omitted many of them altogether. I should be glad to give vent to the sensation of freshness, cheerfulness, hope, and delight on first visiting America, and seeing such a glorious prospect of rapid progress in knowledge and civilisation, a feeling which I retained to the last; and my work will not be the worse received here, from my being able to declare how much I found of a kindred spirit in the state of society and institutions of our Queen's most loyal subjects in Nova Scotia. I could wish that what I draw up by-and-by,

when I have heard from you, should be shown to some candid Southern man. I do not think that these points of difficulty would come once in twenty pages in that fourth or fifth part of my volume which is not made up of purely scientific memoirs. I shall have to talk of the sea-shells in Boston harbour being in great part like European species, of forest trees, humming birds, the absence of heaths, azaleas, distinctness of plants and animals, tortoises, alligators, &c. After all, I was so much in cities, with men who were not mere naturalists, and have had since my return to talk right or wrong on United States affairs, with those who know less of them than me, that I should like to have my say. A manager of the Maryland Iron-works, when I stood up against the tariff and for free trade, said: 'I grant all your political economy, and you may be right, if to increase wealth and population was the only good; but I ask you, as a literary and scientific man, whether you want to have all the United States property represented by farmers? You have seen them in New York, in Connecticut, in Pennsylvania. By a protection to manufacturers you get a higher class into the country. Iron rails will cost somewhat more, but do you wish for that dull monotony of a nation of small landed proprietors? Here, in Maryland, if anyone does by chance accumulate a little capital, his luxury is litigation, and it soon evaporates.' *À propos* to this I was told that if a Connecticut farmer sold off, and invested all his money at six per cent., his average income would be no more than 80*l.* to 120*l.* a year in English money. If so, they are below the average farmers with us, who, though not proprietors, are worth more. Mr. Jared Sparks told me, I think, that Philadelphia would have been the capital of the United States, *vice* Washington, if the revolutionary soldiers in arrear of pay had not been alarming to the Legislature.

Nothing astonishes me more in reading most books on the United States, and hearing people talk, than to see how they attribute to democracy and your institutions both the evil and the good which existed under the monarchy. If in deference to your judgment, or that of any other in whom I place equal reliance, I were to say nothing of these topics, I should at least be able in conversation to talk with more

effect on the United States affairs. So many people besides Sydney Smith have said that I ought to give them a book on what I saw and thought *de omnibus rebus*, that the presumption of saying a little in the course of the journal on moral and political matters seems less than it did. But, on the other hand, I feel that I ought to have seen schools, and attended legislative assemblies, and so forth, and that I might say, what is the truth, that I avoided giving any time to collect facts and observations on these heads, and therefore feel that I am not entitled to speak on them. Meanwhile, I shall try my hand at the 'Journal of a Naturalist and Geologist,' and see how it promises.

Believe me, ever most truly yours,

CHARLES LYELL.

To the REV. DR. FLEMING.

Kinnordy: October 17, 1842.

My dear Dr. Fleming,—We returned after a delightful tour in the United States in August last, in nine days and a half from Halifax, after a month's tour in Nova Scotia.

In all we were absent thirteen months, less than one of these being spent on the ocean, nearly ten in active geological field work, and a little more than two in cities, during which I gave by invitation some geological lectures to large and most patient audiences.

We leave this for London on the 25th instant, but shall be here till then, and, my father and mother desire me to say, shall all be most happy to see you and Mrs. Fleming at Kinnordy, if on such short notice you will do us the friendly act of accepting the invitation. I shall then be able to tell you *vivâ voce* what it would be in vain to attempt on a sheet of paper, of what I saw in the other world.

I shall also have some news to tell you of the Balruddery lobster, alias cherubim.[1] Suppose the 'blackberries' which accompany it are the said lobster's eggs? But I must not indulge in these matters, but pray you to come, and with my wife's regards, believe me, ever most truly yours,

CHARLES LYELL.

[1] This lobster was the crustacean *Pterygotus*, and the 'blackberries' called *Parka* are believed to be its eggs.

To Professor Sedgwick.

Kinnordy, Kirriemuir: October 18, 1842.

My dear Sedgwick,—As we so rarely have the privilege of seeing you now in town, as of old, I shall not trust to meeting you in November, though I hope we may, but write to ask some news of your proceedings and your health. We had a very good muster of working geologists in May last, at the anniversary of the Geological Association at Boston, and they have many excellent men, as both the Brothers Rogers, Hitchcock, Vanuxem, Hall, Emmons, Conrad, and others. I have brought home three dozen boxes of specimens, the fruits of nearly ten months' field work, and I shall open my budget in November, with a paper on the lake ridges, as they are called, and the elevated beaches of the Canadian lakes, with new facts obtained during a second survey of the Niagara district, and bearing on the recession of the Falls, and on the drift of the valley of the St. Lawrence. I shall afterwards have to open ground on the tertiary, cretaceous, coal, and older rocks. I was very glad that you joined my friend John Carrick Moore in Galloway, and we heard sundry reports of certain fair ladies having rejoiced in the bad weather, which kept the philosopher indoors. So you see how these scientific news travel across the Atlantic. Your announcement of coal plants in the Rothliegendes at Whitehaven interested me much, and I should like to talk to you of the zoological fossils, if any, in the same beds. A lady sent us the important intelligence last week that Professor Sedgwick had found organic remains in granite, which her reverend informant had told her was very satisfactory, as overturning all received geological theories respecting the antiquity of the earth. This story has perhaps some foundation, and you have really hit upon some novelty in the old rocks this summer? We are here till the 24th instant, and hope on the 28th to be in Hart Street, at the old family mansion. Let us hear from you there or see you. My father and other members of the family here desire to be remembered to

you, and with my wife's kind regards, believe me, my dear Sedgwick,

Ever most truly yours,

CHARLES LYELL.

P.S.—Remember us to the Master of Trinity College when you see him.

To SIR PHILIP EGERTON, BART.

December 21, 1842.

My dear Sir Philip,—We should have been very glad to pay you a visit, which we have really long looked forward to with pleasure, but must wait, and be a little stationary after such wanderings. To have examined the fish teeth with you would have been most improving, and just what I want, but I must really work in my cabinet to subdue my great mass of arrears. Lord Enniskillen will tell you that on Wednesday last I gave out nearly two hours of my American budget, and return to the charge next time, but I shall not open upon Big Bone Lick till after you are here. I send more than three hundred separate squaloids, but beg you will not bother yourself if you find the task tedious. I should be most glad if you would look at the Martha's Vineyard, marked 'M. V.,' because I am clear for this formation being post-eocene, whereas the geologists over the water have been disputing whether it was cretaceous or eocene. Most of the teeth are lettered.

Lonsdale writes in better spirits, and is collecting and observing the living polyparia.

Ever most truly yours,

CHARLES LYELL.

To HIS WIFE.

Bristol: August 13, 1843.

My dearest Mary,—My journey answered very well, as I had my back to the engine, and therefore escaped the air in my face, and the weather was delightful. I had some intelligent companions: one of them, a Bristol solicitor, told me that the twelve miles of rail from Bath to Bristol cost

80,000*l.* per mile, near a million sterling. It is a fine specimen of Brunel's stylish way of engineering—such viaducts over the river and tunnels! We went fifty miles an hour for several miles, and once for two miles more than fifty. Soon after my arrival I was with Mr. Stutchbury, seeing coal plants in the museum, then with him to Durdham Down, where the 'Permian' saurians [2] were found, &c., then home by the Hotwells, Clifton. Next day with Stutchbury to Bath on the rail, and then eight miles south to Radstock coal-mines. Went down some hundred fathoms in an iron bucket, and spent five and a half hours underground, going miles in coal galleries; much delighted, as the mines were dry and in a good state—upright trees, roofs full of ferns, &c.

I hope to meet Ramsay at Bath, and may catch your train at Bath, or more likely midway between Bath and Bristol. I am grateful to think my eyes are keeping well in spite of fossilising.

With love to all of you,

Your affectionate husband,

CHARLES LYELL.

To HIS SISTER.

Giant's Causeway: September 4, 1843.

My dear Marianne,—We have just returned from a walk over the grand pavement, the effect of which was as picturesque as the evening sun and some white breakers rolling and foaming over the black rocks could make it. Much as I have been pleased with the sight, it strikes me that there are parts of Staffa away from Fingal's cave, and which travellers have seldom leisure to visit, which are even finer in precisely the same style.

The geology of Antrim is very interesting, so many formations, such as chalk, green sand, lias, new red, and the coal being each represented by such distinctly characterised and yet such thin sets of strata compared to the same groups elsewhere, and then the grand trap or basaltic mass covering and cutting through all. The people of this more northern

[2] These conglomerate beds and their remains are now considered at the base of the new red sandstone.

region, like the heather-covered hills, are wonderfully more like the Scotch than those of the southern counties—less handsome and to us less interesting. They are (I speak of the humbler classes only) not so foreign, but like Scotch who ought to be more thriving, who are content to be in rags when you perceive that their circumstances ought to make them above it. But we have been for the last two days very much among a Catholic set, and whether these are more degraded I know not. The begging continues in spite of great poor-houses, which, by the way, are far better in an architectural point of view than those in England. I think the sordid penury of the Irish which Von Raumer described must have been exaggerated, for he had only time to take a superficial view, as we do. All agree, however, that the habits of the people in regard to temperance have worked wonders even since Raumer's time. I have much more hopes of them after having seen the country. How fortunate are we that we have not a black slave population to turn into true and quiet subjects, instead of the quick, obliging, and fine-looking natives of this green island, properly so called, for the verdure is very remarkable! I got a new light about repeal from Lord Rosse. The farmers in Connaught had become so annoyed at the exactions of the priests that a strong feeling of resistance was gaining ground, which would soon have spread, as the same spirit was manifested elsewhere, at Parsonstown for instance. O'Connell was able much more easily to get the priests to join in the repeal agitation, in order that by that greater excitement they might be led to forget the other grievance. This has answered for the time, but it shows that had Government paid the Catholic priests, as they do the Irish Presbyterians, the farmers would not have tolerated their Romanist church dues, and the priests would have been forced to receive support from the State, and would then probably have been no longer rebellious. In short, until they are raised in the scale there is no hope of their flocks improving, all which I presume Sir R. Peel and the Duke have long known, but they would never have carried any measures. One cannot help fearing that the anti-English spirit has sunk deep into the hearts of the millions here, for they read nothing but

O'Connell's newspapers, from which he artfully excludes, without appearing to them to do so, every other foreign or domestic topic of interest except repeal and Irish grievances, a great proportion of them now bygone. You will be glad to hear that even if the gigantic telescope of Lord Rosse should not succeed—of which, however, there seems no apprehension—the great one which we looked through has achieved grand results, not only reducing nebulæ into clusters of distinct stars, but showing that many of the regular geometric figures in which they presented themselves to Herschel, when viewed with a glass of less power, disappear and become very much like parts of the Milky Way. Lord Rosse showed me a model which he had made of one of the mountains in the moon, which I thought not so much like a volcano as one of the largest atolls, its sides being externally so steep and lofty and its crater sixty miles in diameter; but you must suppose the lagoon of enormous depth, and the ocean, of course, to be removed. During our call on the Archbishop of Dublin he said, among other things, that he thought that brutes used language for communicating ideas as we do, but never, like us, as an instrument of thought. We were much diverted with a story told us of one of his eccentric ways of taking exercise. He used to go to the seashore with Dr. Dickinson, the late Bishop of Meath, and they would go on for three hours together throwing up pebbles into the air, each trying to hit the other's pebble. I have no doubt that Whately was sometimes speculating on the doctrine of chances, and calculating how many misses went to one hit; but his chaplains were in several cases obliged to interfere, and succeeded in representing to him that some of his gymnastics were not in Dublin thought quite dignified enough in an archbishop. Our scientific meeting at Cork went off pleasantly and very well as far as concerns the muster of scientific men, but the money received was not near half the usual sum, owing entirely to the gentry of the neighbourhood and county holding off, except the Lord Lieutenant and a few others who had originally joined the town in inviting us. The reason of this was that the townspeople, comprising many rich merchants and most of the tradesmen, were repealers, and the agitation having occurred

since we were invited, the opposite parties could never in Ireland act or pull together. In addition to this, however, the gentry in Ireland, at least in the south, seem very much behind those in England in interest for any scientific matters. We are struck with the similarity of the common flowers and plants here to those of England, Scotland, and France. Certainly the naturalist has a great additional pleasure in touring through Canada or the United States in the surprising novelty of all the wild plants and animals. We had an amusing scene in starting from Limerick, the coach being already full, and a petitioner addressing the guard very eagerly with, 'Will I come up? that's the proposition.' To which the reply was, 'Where can you sit? that's the query.' The other saying he would go on the baggage at the top, he was told to lie flat, or his head would be taken off going under the arch, and by way of comfort he was asked, when in a great fright, if his life was insured. 'No.' 'So much the worse for your wife!' All this passed as quick as thought. We have seen many remarkable round towers, as at Kildare, like the Brechin tower but taller; also many ruins of monasteries. The school-houses, often very neat, pretty buildings, put us in mind of the United States, and we are told that the Catholics and Protestants get on well together in these schools, and are each allowed their own version of the Scriptures.

Since I began this we have seen more of the Causeway in delightful weather, but I shall leave Mary to tell you of this. With love to all at Kinnordy,

Believe me, your affectionate brother,

CHARLES LYELL.

To JOHN CARRICK MOORE, ESQ., CORSWALL, STRANRAER.

Kinnordy: September 17, 1843.

My dear Moore,—We made out our tour very successfully, seeing the Ballantrae section, and going the old road by Alloway, so as to see the witches' bridge and the ruined church where they danced, and Burns' monument, and the cottage where he was born, and still just reached the five o'clock Glasgow railway train, so that we got a good long night's

rest before starting the next morning by six o'clock. We found the two parcels had come safe by the 'Maid of Galloway,' and were already in the hotel. Had we not been free of these incumbrances, and had not the cars ordered by you been all ready, we could not have accomplished all this by five o'clock at Ayr. The geology at Ballantrae [3] was quite what you had given me to expect—a small dike of serpentinous trap about one foot broad, and running magnetic N. and S., being the only fact which you seem to have missed. I certainly think the red sandstone is newer, as your white and variously coloured sandstones of Sloughnagarry are older, than the conglomerate with fragments of graywacke. As to the said conglomerate and the red sandstone, we can say nothing more of its age. I saw ripple marks and casts of cracks, and perhaps fucoids (?) as you did. As to crustacea I could not detect any good markings to confirm that idea. But I saw distinct rain drops. Study the recent ones on the shores of Lough Ryan in all states, after a short shower and a hard one, and after hail, and when half effaced by tide, &c. In short, that Lough is a grand magazine of geological analogies—tidal, littoral, conchological, sedimentary, &c.—which I envy you having at your door. My father saw here a splendid meteor, and other neighbours did at the same moment, as large as a man's head, more splendid than the moon, on Wednesday the 6th, at a quarter past eleven o'clock P.M. One person thought he saw it divide. The Milmans arrived here a few hours after us yesterday, all well, and in fine weather, their three sons with them.

My wife joins in kind remembrances to your whole party, and we are glad to have finished our tour with the recollection of so agreeable a visit.

Pray tell Mrs. Moore they have had the good taste to put the sculptured Tam o'Shanter and Sutor Johnnie in an apartment separate from the monument to Burns.

Yours very sincerely,

CHARLES LYELL.

[3] On the coast of Ayrshire.

To Sir Philip Egerton, Bart.

Kinnordy, Kirriemuir, N.B.: September 22, 1843.

My dear Sir Philip,—I was in hopes of learning from the Milmans, who have just left us after a visit of five days, in what part of the world you and Lady Egerton might be at present, whether to the north or south of us, but as I could get no intelligence I shall send this to Cheshire to be forwarded if you are in the Highlands. We are only a week returned from Ireland, having gone from Killarney to the Giant's Causeway after the Cork meeting, visited Lord Rosse on the way, and seen his telescope, besides seeing other Irish friends. My Auvergne tour was also very successful, and I shall be glad to talk with you on the wonderful collection of mammalia, of one hundred and sixty five extinct species of all periods from the eocene to the pliocene, which the Abbé Croizet and Bravard have disinterred from the old fresh-water marks and the volcanic alluviums, &c., of all ages. But I have only time in this letter to beg you to let me know whether you shall be returning from the Highlands to the south before the first week of November, or going northwards from England, as in that case I should like to send you a special invitation from my father to stay here some days on your way. The only visit we have to pay is to Aberdeen, and I might regulate the time of that by your movements, if you would write immediately. We are enjoying delightful summer weather here, after having had already two summers, one in France and one in Ireland.

Ever most truly yours,

Charles Lyell.

To His Sister.

December 7, 1843.

My dear Marianne,—We went yesterday to Mr. Curtis, who named for me my N. American insects. The fire-fly is a *Lampyris*, very like the Italian one which I saw in 1818 in the rice-fields near Padua. I am going to-day to visit poor Mantell, who is very ill. I am getting on very steadily with

my geological travels in North America, and am particularly working at the fossils, which can only be done by getting the assistance of many others in different branches. Edward Forbes has helped me for my chalk fossils of New Jersey, and I have packed up some twenty packages of American corals from different rocks, and sent them off by Lonsdale's invitation to Falmouth. Having seen in the United States that there was no one who understood the corals, and only two men in France, I willingly let these specimens run the risk of another 600 miles of travelling, though I wish my naturalist was nearer. To class and pack them was no small work for me and my new aid, young Sowerby; I miss Hall[4] in a hundred little arrangements. Three Institutions at Manchester clubbed together, to invite me to give twelve lectures at each, repeating the same. Mr. James Heywood was deputed to negotiate with me. I told him that, had my occupations permitted it, the average sum per lecture was about one-fifth of the fee for which alone I could think of lecturing anywhere, or had done so, in the last three years. The fact is that there, as everywhere in England, magnificent subscriptions which might have endowed lectures equal to the Lowell Institute, have been all spent in building, and it is the same whether 50*l.* or 150,000*l.* are subscribed in this country; and as in the case of the London University and King's College here, the buildings, which cripple them with debt, remain unfinished. If anyone should have the wisdom of Mr. Lowell, and forbid a farthing to be spent on building, an institution with half the funds of the K. C. or L. U. would have the pick of all the first teachers, and leave the rest behind.

Believe me, your affectionate brother,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

London: December 27, 1843.

My dear Mr. Ticknor,—We are reading Mr. Prescott's 'Mexico' with great delight. I have not seen Milman's

[4] His clerk, who had been eighteen years with him, and who died of consumption the previous month.

review in the 'Quarterly,' but he has been so much overworked lately with parochial and other professional duties, by which his health has suffered, that I shall be relieved to find the review worthy of Milman and the subject; at least the reviewer was much pleased with his task. The parts on which Mr. Hallam, when he talked of it to me the other day, dwelt with high commendations, were the essays in the beginning, and the appendix on the Aztecs, the aborigines, &c. Everybody seems to be reading it. I was much pleased with the comparison between the human sacrifices of the Spanish Inquisition and the Mexican priests, and the justice done to Montezuma for not becoming an apostate. I am very much obliged to you for your information, and that sent by Mr. Sparks, and had I not been very busy in preparing for the Geological Society papers on the plumbago of Worcester and the green sand of New Jersey, I should have digested the matter you sent me, and read up to it by aid of your references. It strikes me that it may do good to remind our ultras here (who could forgive the Americans more easily for dispensing with a King than for doing without a church establishment) that in the monarchical times of the States all sects were, as now, on an equality.

If I can state this broadly it would astonish many. It was new to me, and people are amazed when I tell them that now, in Nova Scotia, all sects are equal by the charter. What struck me was the advantage in a country open to colonisation of finding no other sect dominant, and one's own politically and socially inferior.

It is not *ungenteel* to be a Baptist or Unitarian. One may know that the orthodox of other creeds believe that one has no hope of salvation in the next world, but one is not irritated by the thought of being despised and thought to hold a low position in this. But was there not once in some part of New England a general provision, afterwards abandoned, for *all* religious sects, a tax levied equally from all, and paid, as in France, to different religious communities, according to their numbers? Was there nothing of this kind anywhere in the United States? It is my *beau ideal* of a *mezzo termine* between the Establishment and the voluntary system, and I believe we have lately begun this in Australia, but I must inquire.

More than half a million have lately seceded in Scotland from the Establishment, and as it is very possible that the leaders of the Catholics and Protestant dissenters may in some future election bury their religious animosities, and make common cause, the time may be nearer than some think when we shall have all sects endowed, which I trust will happen, instead of none being so. But, at all events, I abhor the political disaffection created in Ireland, Scotland, and England by the exclusive privileges of Church of England ascendency.

It is really the power which is oppressive here, and not the monarchy, nor the aristocracy. Perhaps I feel it too sensitively as a scientific man, since our Puseyites have excluded physical science from Oxford. They are wise in their generation. The abject deference to authority advocated conscientiously by them can never survive a sound philosophical education.

Ever most faithfully yours,

CHARLES LYELL.

CHAPTER XXIV.

JANUARY, 1844—DECEMBER, 1846.

LETTER TO MR. TICKNOR ON AMERICA — FOSSIL BOTANY—GOES WITH FARADAY ON A COMMISSION OF INQUIRY ON ACCIDENTS IN THE COLLIERIES—BLANCO WHITE'S BIOGRAPHY—NEWFOUNDLAND—ICEBERG—POLITICS IN MAINE — VEGETATION IN GEORGIA—SLAVERY — CHEIROTHERIUM—ICEBERGS—LETTER TO EDWARD FORBES, AND REPLY—DINNER AT MILMAN'S—VISIT TO BOWOOD.

[In the autumn of 1844, a disastrous explosion took place at Haswell Colliery, Durham; on which the Government instituted an inquiry, and at the request of Sir Robert Peel, Mr. Lyell and Mr. Faraday went as Commissioners, and prepared a report on the causes of the accident.

He attended the British Association at York this year, and in 1845 he published his 'Travels in North America, with Geological Observations.' In September he returned to the United States, and had a still more extensive tour in the countries mentioned afterwards in his 'Second Visit,' some of the geological fruits of which have also appeared in separate scientific memoirs. He was nine months absent from England, returning in June, 1846. He attended the British Association at Southampton, and in September moved to 11 Harley Street, after spending fourteen happy years in Hart Street, Bloomsbury, but his collections demanded more space.

His travels in 1847 were confined to England and Scotland, and he attended the British Association at Oxford.

In 1848 he visited Southampton and other places in England, and went to Scotland. From Kinnordy he rode over the hills by Clova and Loch-na-gar to Balmoral, when he had the honour of being knighted by the Queen, in September.]

CORRESPONDENCE.

To GEORGE TICKNOR, ESQ.

16 Hart Street, Bloomsbury, London : January 7, 1844.

My dear Mr. Ticknor,—I found your letter on our return from Cornwall. Your information respecting the slaves, and your speculations, were most interesting to me. I had arrived at the notion, from reading Gurney's book on the West Indies, that in the most Southern states, and wherever rice and sugar are cultivated, the emancipated negro might stand the competition of the white labourer.

But in all the higher parts, and many of the low grounds of Virginia, Maryland, the Carolinas, and Georgia which we saw, I should expect the free black to give place, like the Indian, before the white immigrant.

You mention Massachusetts having refused magistrates and use of prisons to those who followed runaway slaves. I should have thought it good policy to give some indemnification in those cases, not the whole value perhaps, and to aim always at sharing the sacrifice required by humanity with the planters, and ultimately forcing the Central Government to incur a debt to set free one state and then another. Mr. Everett told me that black men did vote for the governor of Massachusetts. De Tocqueville says that the free blacks do not dare to vote. He also says that they die out much faster than slaves. If so, must it not be for want of an adequate poor-law system ?

I thank you much for the admirable pamphlet 'The State Debts,' which it is painful to read, and reminds me of the state of indignation which I was in at Naples, when associating with a set of proscribed literary and scientific men, who seemed to me very moderate in their political opinions, but who were so far in advance of their own countrymen and government as to be martyrs to their patriotism.

There was an absolute power over which they had no control, and which had no sympathies in common with them.

I should do injustice no doubt to the legislature at Harrisburg were I to compare them to the corrupt government of Naples; still I could not help feeling that the men of finer intellects in Philadelphia were under the control of men of coarser clay, delegates of the Pennsylvanian rural population. On them I cannot help fearing that the manly and spirited and touching appeal of your friend will be thrown away, yet I hope most sincerely that I am mistaken. I had an argument the other day with one of Lord Ashburton's suite (in 1842) about the cause of repudiation, I attributing it to the ignorance of the lowest and most numerous class of voters, especially those newly arrived, or who do not advance with the rest, because of a different language, &c., he maintaining that it was simply the sharing of the shame among so many which alone prevents communities from dishonesty, and which no ministry or moderate-sized constituency could endure or brave. Surely it is not a question whether popular governments can be virtuous and honourable, but whether the democratic principle has not been carried out so far as to subject the educated to the uneducated, those who have independence of fortune and leisure to those who have neither. Is it Utopian to try to raise the franchise and exclude those not born in the United States? When were settlers of five years' standing first admitted to vote? When that passed, they should all have been received into colleges and educated for the first five years, and not allowed to clear the forest, &c., till afterwards.

As an admirer and well-wisher of the United States I look upon this particular breach of faith, with all the loss and misery occasioned by it on both sides of the water, as a trifling matter compared to the symptoms of some inherent disorder in the general constitution of the body politic. If the opinion of the more highly-educated, wealthier, and middle classes can have so little control, or act so tardidly on the vast majority below, an impolitic or absurd war, or some measure as serious as the disunion of the States, or any other mischief, might as readily occur, in direct opposition to the almost unanimous sense of those who, for the good of the whole, ought to govern.

I am getting as prosy as if I were upon our Anti-Corn-

law League, or the Irish state trials. But I hope you will indulge me with a like 'expectoration,' as a German scholar said to our great botanist Robert Brown, meaning that he should unbosom himself.

Ever most sincerely yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

London: April 2, 1844.

My dear Mr. Ticknor,—Have you seen Godley's book? He agrees so entirely with the opinions we formed on almost all points when his *Catholic* Church notions do not interfere, that I am much pleased with the work. It is a great contrast in its tone of feeling to the ordinary English portraits of America and the Americans, and even his Puseyism will be a bait to precisely that class of readers who from their anti-democratic, high church principles, are the most prejudiced against the United States.

I have heard some of this school say of late that there is one and one only redeeming point about the United States —the recent progress of the Episcopal Church. How far is it true that the German professorial system is almost universal instead of our tutorial system, which, for my part, I think a very bad one in the universities, as it does not inspire the pupils nor the teacher with a love of what they learn or teach? I hope it is true that the physical sciences have as large a share of attention in the United States colleges and schools as this thorough Oxonian complains of their enjoying. He says that the Americans will admit any sect to be Christian and Protestant which receives the Christian scriptures, and any doctrinal scheme which it thinks may be deduced therefrom, so long as it allows all others to be equally right who do the same; also, that the American mind has a natural repugnance to anything which affects an exclusive or dogmatic character. This is his heaviest charge against you. I wish I felt as sure as he does of its truth. One great evil which I complain of in our system of education, both in schools and colleges, is the monopoly of all professorial and tutorial places, masterships and usherships in

schools, &c., by the clergy. Their *Catholic* propensities have led them to seize upon professorships of astronomy (Armagh), geology (Cambridge and Oxford), botany (Cambridge), mineralogy (Oxford and Cambridge), natural philosophy (King's College, London), engineering (ditto), political economy (ditto, Prof. Jones), and I could give you a long list of others. In divinity, church history, Hebrew, and many others we would not grudge them exclusive possession, but the evil now is, that they not only regard the sciences they teach as subordinate to professional duties, but are liable, if eminent in science, to be rewarded by church preferment, and immediately stopped in one career of usefulness. I was told of a college in Albany, I think, newly established on Oxford principles, in which all the teachers seem to be Episcopalian divines, and no physical science or natural history to be taught. We are struck with the fact that amongst the many *families* we visited at Boston, New York, Philadelphia, and other places in south and west, altogether more than a hundred, not one was residing in a boarding-house, and yet this is represented as the American mode of living.

Ever most truly yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

16 Hart Street, Bloomsbury, London: June 12, 1844.

My dear Mr. Ticknor,—I have two of your letters before me unanswered, and we are just stepping into a steamer, which in forty hours is to carry us nearly five hundred miles northward, so I must thank you first for what you told me of your universities and toleration, on the excess of which Mr. Godley had been so eloquent. I was very glad to see by your letter to your French friend, which I read and forwarded immediately, that you had such hopes of the country, about which I am sufficiently sanguine myself, if time be allowed. For what is fifty years in the history of a nation, or any great experiment in politics, and the art of governing men under entirely new circumstances? If the institutions are in arrear of the point of civilisation, morals, and knowledge to which the people have advanced, I doubt not that

they will rally and put things right; but as it is a costly machinery which requires such a stir as you are now making, in order to remedy abuses, I hope some improvements will be made to cheapen and simplify it, all which will come, and I hope in our time. Your public men ought to be more upright and independent than ours, because, owing to the wider distribution of the means of living, and of education and other causes, people whom they govern are as a whole superior. If the constituencies or voters as a whole are not better than ours, this must be and will be in time improved, first by excluding foreigners, and then by a property test. I cannot imagine that universal suffrage can ever be good for any community, and where it is so easy to acquire some property, and implies such a want of industry to be penniless, it must be still less unjust than here to exclude all who are not tolerably well off. As the suffrage has undergone so many modifications, surely the idea of restricting it within less wide bounds is not Utopian.

Ever most truly yours,

CHARLES LYELL.

To CHARLES BUNBURY, ESQ.

1844.

My dear Bunbury,—I was very glad to hear from you, though I have not time to say half the things which your letter has set me thinking upon. When my friend Babbage heard you were upon fossil plants, he said it was a good thing, as in such cases 'two and two made more than four,' and I hope together we shall strike out some improved view of the carboniferous era so far as relates to its chief feature, the flora of its strata. The identity of the *Pteris aquilina* with some impressions of coal plants so far as leaves are concerned was new to me, though to a superficial eye the resemblance is striking. May we be led by this to doubt whether the European and American coal-ferns, which seem equally identical, may really have been distinct in species? I think not. Some of the genera of shells and corals of the carboniferous period are the same as living ones, but not the species in any instance. The Virginian morasses allow, under a hot summer sun, great accumulations of black vege-

table matter, nearly like peat, and which might make coal. The shade of *Cupressus distichi*, *Thuya*, and water-oaks, &c., shut out the sun, and ferns and mosses grew in the damp air beneath, while the heat causes evaporation, and evaporation cold. One swamp is forty miles long by twenty, which I saw. Thousands of prostrate trees in the peat. I hold Ad. Brongniart's atmosphere of carbonic acid in the coal period to be apocryphal, and if you can relieve us from intense heat, so much the better. The corals and shells of the then existing seas in northern latitudes show a warm state of things far from the line.

Believe me, ever affectionately yours,

CHARLES LYELL.

To CHARLES BABBAGE, ESQ.

October 7, 1844.

My dear Babbage,—Mr. Phillipps called here to-day, and told me he had felt at liberty to lay your letter before Sir Robert Peel, Sir James Graham not having come up; and that Sir Robert had asked him, Mr. P., to go and ask me if I would go down with some chemist, Faraday, if possible. I told him that I thought I should not carry down the sort of knowledge most appropriate; that a lawyer, or one like you, of general scientific knowledge, and special in mechanical affairs, and to whom he, P., had first applied, would be better. He replied that Sir R., having seen me mentioned in your letter as being in town, and thinking that a geologist who had had to do with coal-mines would, combined with a chemist, do best for them, had asked him to invite me. I said I was very busy with my American book. He, P., said 'it would be fully as inconvenient or worse for Mr. Babbage just now, as he assured me.' I said, 'A coal-viewer and Faraday would do better.' He replied, 'No; the Government will empower you in your credentials to employ any coal surveyor you like, but they want scientific men known in your and Mr. Faraday's line to be there.' I accordingly agreed, and Faraday has done so too, as I hear from Phillipps since. I observe that in all the Parliamentary reports of 'children in collieries,' 'accidents in collieries,' &c.,

1835 and 1841, the geology of the district and position of the coal seams is laid down with minuteness, maps and sections. I therefore perceive that there is a geological side to the commission, and if I get knowledge or credit I have to thank your letter for it, and only regret we do not go together. I hope still to be back so as to see you, if disengaged, with Sir David Brewster on Sunday evening next, when, at all events, my wife will be *at home*. I hope Phillipps will write to you, as he said he should, about our long conference, and acknowledgments for your prompt aid to the Government.

Sincerely yours,
CHARLES LYELL.

To SIR PHILIP EGERTON.

16 Hart Street, Bloomsbury: October 22, 1844.

My dear Sir Philip,—I should have answered your kind letter sooner if I had not been very unexpectedly, and just when I thought I was settled in for the winter, and at my American book, induced by a direct invitation from Sir R. Peel to go with Faraday and attend the Haswell inquest, and see into the cause of the accident and suggest a remedy in future. We have only just drawn up our report to Sir J. Graham, in which the geology is a small part, the chemistry a large, and if I mistake not, a most valuable one, practically speaking.

I am very much obliged to you for offering to compare the fish, and will send them soon, and wish my engagements would have allowed of our accompanying them, but I regret to say this is not the case.

I shall write again soon, when I send the fish, and reply to you a little more fully.

Ever most truly yours,
CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

London: March 1, 1845.

My dear Mr. Ticknor,—I am trying to negotiate with Mr. Lowell for a course of lectures from the celebrated Agassiz, the ichthyologist and Swiss naturalist and writer on glaciers, for 1845–46, but, perhaps, all are filled up. Ch. Buonaparte, Prince of Canino, has offered to take him to the United States, as he visits it with his son this year. I am sure Mr. Lowell will do it if he can, as I have answered for his English being passable. You will be much pleased with Agassiz, and his visit will be most useful, as it always is to us when he comes here. The British Association has thrice voted him sums of money to describe our fossils.

The marriage of Ward, the Oxford Puseyite martyr, is delightful, as illustrating their Romanist zeal for the celibacy of the clergy. Milman wonders if he will sign the marriage articles, as well as the thirty-nine, in a 'non-natural' sense, and has always maintained that the ladies and the rich endowments of the Anglican Church will keep the majority from Rome. He was joking in this way with an intimate Puseyite friend, a very thin man, Mr. Manning, the other day, and said how fortunate it was there were so many sleek incumbents of livings, and looking at Manning, he said:

> Yon Cassius has a lean and hungry look,
> He thinks too much—such men are dangerous.

Believe me, ever most truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Kinnordy: July 27, 1845.

My dear Horner,—I was vexed to hear you had so much work thrown on you at the Geological Society. I regret it the more as I am much struck with the value of the first and second numbers of the Journal, and wish it was generally known how much we owe them to you. But next year the machine will work better. I forgot to thank you for having

sent the 'Spectator,' the first critique I saw.[1] I mean to send them to Mr. Ticknor, or take them to him, because they all show how willingly our press welcomes anything favourable to the United States, though I suppose some of the bitter anti-American magazines will act otherwise.

Blanco White's book keeps up its interest to me, and certainly it should teach every scientific man to modify his opinions, and never to contend for doctrines, because he may have once favoured them, as soon as new discoveries, facts, and reasonings, require their modification or abandonment. The little suffering or annoyance that he, or his self-love, have to endure, is so insignificant in amount in comparison to the penalty which the theological professor must pay for relinquishing a little of any one of the numerous dogmas or forms of interpreting scripture, which he has pledged himself to adopt for life, that he must feel ashamed if he hesitates for a moment to recant, after reading the confessions of Saint Blanco the Martyr. For the sake of this moral, which I hope many a philosopher will draw from it, I am glad that all his sufferings are given in full length.

Dr. Falconer showed me the Dinotherium tooth from Perrin Island, just like one I saw from the marine *faluns* of Touraine, and confirming me in the view I had previously expressed and printed in the Asiatic Society's proceedings, that the formation was Miocene.

Yours affectionately,

CHARLES LYELL.

To CHARLES BUNBURY, ESQ.

Kinnordy: July 28, 1845.

My dear Bunbury,—I have been re-reading your letter to me on fossil botany with no small interest, as well as your excellent abstracts of Ad. Brongniart on *Sigillaria*, *Stigmaria*, &c. Now, pray give me the benefit of your last ideas on the climate of the carboniferous period, as deduced from the plants, and refer to the last edition of my 'Principles' about the minimum of light, and criticise this. The near resem-

[1] On his travels in North America.

blance of the pteroid ferns is, as you say, a warning not to assume extraordinary heat, and you ask if in old formations we find some genera of animals very like living ones, mixed with very anomalous and unknown forms. Certainly we do. In regard to shells we have carboniferous *Orthocerata*, with nucula and many other shells very like living ones, and I might accumulate cases in other classes, so here the flora and fauna yield analogous results. In one letter you allude to the idea of a continuation of Lindley and Hutton's 'Fossil Flora,' but probably you will think better of the plan, and either give us first a carboniferous fossil flora, to be followed, as circumstances may lead you, by other floras, or some other independent work. The fact is, that the science will have got so far beyond the point where Lindley left off, that even in treating to an English reader of the very species and genera which Lindley spoke of, you would be able to write articles sufficiently original, and if you give your time gratis, and do not make money, or very little by such a work, you would do wrong, both for your own sake and that of science, not to have a work quite distinct from any other, and without any associate, for there is great disadvantage in joint authorships, partly because no one knows who is answerable. To make your knowledge useful your name must acquire authority, so that independently of laudable ambition, you should take care to get known by the title of the book. Probably a 'British Carboniferous Flora,' like Owen's 'Mammalia,' would sell best, and whatever foreign knowledge you obtained of American, or other carboniferous plants, would still tell upon it. I would not have you delay more than a year from this time in organising some plan. I persuaded Owen to change from monthly to every two months, which he rejoices in, but the frequent coming out of new parts keeps the public interest alive, and leave of absence for a foreign tour can be obtained by getting a few parts ahead.

With love to all, ever affectionately yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

Kinnordy, Kirriemuir, N.B.: August, 1845.

My dear Mr. Ticknor,—I have been finishing the autobiography of St. Blanco the Martyr. I wish he had said more about Ferdinand and Isabella. You remember my argument with you, that our friend (Prescott) would have done well if he had pointed the moral differently, or more strongly, to show how the result of the energy and talents of his heroine, considered as a monarch, was to place the force of an established monarchy and a great standing army at the command of that new church inquisition, which was to crush the free spirit both in political and ecclesiastical matters of Aragon. In short, her superstition, combined with her virtues, was laying the foundation of the future degradation of her country. The historian might have liked the woman more, for trusting with so much faith to her father confessor, and yet dwelt with pain on the degree in which it unfitted her most fatally to be the founder of the political constitution of a great country.

I told you what I had heard of certain letters in Blanco White's biography. I admired those of Channing very much; and that concluding passage, vol. iii., p. 312, where he compares the undertone of truth, in spite of the occasional falseness of particular views, to that general solemn roar of the sea which is quite distinct from the dashing of the separate waves, is as just and well applied as it is poetic. Mr. Norton's letters also are excellent, and the whole work is painfully interesting.

Remember me most kindly to Mrs. Ticknor and your daughters.

Believe me, ever most truly yours,

CHARLES LYELL.

To HIS SISTER.

Off Trepassey Bay, Newfoundland: September 15, 1845.

My dear Marianne,—Here we are within three and a half miles of the coast of Newfoundland, which, although it lies in a direct line to Halifax from Cape Clear, we did not

approach in the 'Acadia' in 1841. The first three days after taking leave of Mr. Horner at Liverpool, from which we sailed on September 4, we had delightful weather and fair wind, making, though heavy with our full freight of coal, 220 to 240 miles a day. Then came our adverse winds and two regular equinoctial gales, which I am glad now they are over to have seen, but they made us both ill. Yet I have had much pleasant and instructive conversation with Mr. Everett, also with Mr. Ward, the American agent of the Barings' house in Boston, well acquainted with all United States affairs. The first equinoctial lasted twelve hours, the second on the 14th, when we were nearing the Great Bank, lasted twenty-three hours, and part of the time a perfect hurricane. But the engineer never missed a stroke, and they have a very full and well-disciplined crew.

When we were near the Great Bank, and the day before our grand gale, we saw an iceberg 200 feet high eight miles south of us. It was too far off to be a distinct object to my eye, though white and visible with a glass. They are very rare this month. This was the day before our heavy squall, and when the wind struck us in the night we thought we were running against an iceberg.

Your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Portland, Maine, U.S.A.: September 27, 1845.

My dear Marianne,—We have just returned from a visit to two of the most eminent medical men of this town, the largest in Maine, 15,000 inhabitants. Dr. Mighels showed us a fine collection of recent American shells, and some fossils, from a formation which interests me, as being a continuation of that of which I have spoken so much in my travels in Canada, which appears here under some new aspects. It is the old Uddevalla affair, with recent Arctic shells; but I was pleased at recognising among the novelties the tusk of a walrus, which my discovery of one in Martha's Vineyard, figured in my book, enabled me to make out. We little dreamt when we left Boston that we should go full

200 miles in a north-easterly direction to Augusta, in Maine, to which I was taken by Squire Allen, as our driver termed the lawyer who was our host. I went to the State house, a handsome building of granite, and saw their collection, made during the geological survey. I was introduced to the Governor of the State, and when you think of 'those wild people of Maine,' of whom Lord Palmerston spoke in those terms during the border feud (an expressionthey will never forget), and learn that this chief magistrate, a Unitarian, has been re-elected several successive years by the democratic party, you might imagine that no great satisfaction was to be derived from the interview; but I found him a quiet, sensible, well-mannered man, who told me he was very desirous to resume the geological survey, which the legislature had suspended from economical grounds, and he drew from me all the utilitarian arguments he could which my travels in the States could furnish, in enabling him to talk over the party who might be averse to the outlay. He was once a Senator at Washington. One of their late governors was a Roman Catholic,—a proof that these New Englanders do not mix up religion with their political divisions.

We have now been in all the six New England states. The constitution of Maine is singularly democratic, members of both houses being elected by universal suffrage, and re-elected annually, and precisely the same qualifications in both for the electors and the elected. The judges, however, are appointed by the governor and council; the extreme in some states is where they are elective. I asked Mr. Allen whether Mr. Gardiner (a rich relation, and one of the most cultivated men in the country, who lives in a handsome house in a park in the English style) had ever been in the legislature or political life. He answered, 'Oh, no; his landed property is much too large: besides that, he derives much wealth from other sources.' I remarked that in Massachusetts I had understood that the reason the electors objected to rich men was that they were inaccessible to them, too much above them, could not be troubled to listen to all their wants. He answered that this motive really operated strongly, for in regard to envy and jealousy, they often felt that as keenly or more so, when they made one of

their equals their representative. Lately, in choosing railway directors at Portland, they objected to the first list because they were too rich and aristocratic, and the numerous petty shareholders wanted to confer with them on equal and familiar terms. Mr. Allen admits that the extent to which the democratic spirit throughout the United States succeeds in making wealth a disqualification for political influence is annoying to many of the richer citizens, but he says that their rights and property are perfectly safe, and all the interests in the country were never so flourishing as at this moment. After all, I suspect that property, especially land, governs here as elsewhere, but ninety-nine hundredths of the land is divided into a countless number of small fractions, and the large proprietors, who own the remaining hundredth, may very naturally go for nothing in the balance. That the acquisition of large estates and fortunes has had the same charm as with us, appears from the eagerness with which they toil to obtain them. A grand railway is planned from this town (Portland) to Montreal, and they hope to get the English steamers to land here, where there is a very fine harbour, and will shorten the road to the British provinces very much. It would be natural, too, that the English mail and passengers should land here, and go 110 miles by railroad to Boston by a rail which carried us at the rate of thirty miles an hour, instead of having so much more sea. All the money, more than two millions sterling, is subscribed, and the road surveyed and the Acts passed both in Canada and Maine. The Kennebec is navigable for some forty miles from its mouth to Augusta, to which the tide goes up. At Bath we saw numerous ships building, destined to carry cotton from the Southern States to England. Streets of new houses rising there, as at Gardiner, Hallowell, and Augusta. New large cotton factories with steam-mills in progress at all these places, new saw-mills for the timber which is floated down the river in rafts, three or four huge steamboats carrying 300 to 400 passengers each going up and down, brigs and schooners laden with hay for Alabama and Louisiana, that the horses in New Orleans and Mobile may enjoy the sweet herbage of Maine, so much better for them than the rank

grass of the rich soil of the western prairies. They are to return with cotton in exchange for the hay. What an advantage to have all this free trade between such distant regions in the same country! On our way here we passed the Wenham Pond, or rather lake, for it is nine miles round, with its pure sandy bottom and fed by clear springs which when frozen over in winter yields the ice sent to London. And now, dearest Marny, I must finish, and before starting for the White Mountains, which they say are already tipped with snow, I will put this into the post at once, though my tale is half told, especially our Portsmouth visit to Mr. Hayes, who drove me in a gig through some green lanes in a delightful forest where the *Coleas* were swarming. Under the trees a kind of gale smelling like our bog myrtle (*Myrica cerifera*) was abundant, and a beautiful *Gerrardia* quite new to me. We collected fossils in this wood. But I must end, with our love to all, and hopes to receive good news at Albany.

Ever your affectionate brother,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Hopetown, near Darien, Georgia: January 9, 1846.

My dear Horner,—I have been visiting the site of three Megatheriums near Savannah, and the places where four or five others, some entire skeletons, were dug up here. I can prove them by their position relatively to beds of marine shells, to be a shade more modern than the elephant and rhinoceros of the valley of the Thames. They co-existed here with our *Elephas primigenius*, the American Mastodon, &c. The modern or Post Pliocene series of changes before and after the Megatherium in this low country are very interesting. Tell Darwin I have quite a counterpart to his Patagonian steps, or successive cliffs cut out of the Tertiary. The botany here, in spite of the season, which is now free at last from frost, and sunshiny, is very striking. The three palmettos—*Chamærops* one of them—a tree actually forty feet high at Savannah, and having all the aspect of a palm tree—are very abundant. The tall cabbage palm in

the seaboard islands, requiring the salt sea-air, the saw palmetto abounding under the long-leaved pines, and blue palmetto in the clay swamps. There is a common bay that grows very high, *Laurus Caroliniensis*, with large leaves, having the odour of our bog myrtle. Magnolias in abundance, and three kinds of holly with red berries. Nothing has pleased me more than to witness the improvement that is going on in the condition and education of the slaves, both in the rice plantations and in the small farms, Sunday Schools being general, oral instruction, though reading feared, lest they get hold of exciting pamphlets. Many, however, do learn to read, and receive presents of Bibles, &c., from their masters. I have seen a large steam engine which has been entirely trusted for fifteen years to a thorough black; all the carpenters here, blacksmiths, &c., are Africans or mulattos. Their masters talk to them as much as we should to Irish labourers, and they of the new generation of blacks calling themselves country born, feel and talk of their superiority to the preceding generation their parents, whom they style *Africanians*, as the young Irish educated in the schools at Boston feel towards their unlettered emigrant sires. Their labour is calculated for eight hours in all the rice, cotton, and sugar plantations about here. They often finish it in seven or less, and it is frequently all over by two o'clock, or twelve or even eleven in the day, after which they usually take some hours' sleep, because it is their pleasure to sit up half the night, gossiping, singing, or listening to some favourite black Baptist preacher. I am convinced that people are too apt to forget the very low platform of civilisation from which the African starts. One-fourth of the five hundred negroes now collected round this house were born in Africa, and to bring them up, or elevate them to the grade of the lowest Irish, is a step far beyond turning the said Irish into the average American labourer's standard. When I see how much has been done in so short a time I begin to be more hopeful than in my last tour, for unless the fanatical party of the North force on a collision, the next generation will be just as much beyond the blacks we see as they are above the Africans, and the treatment of them is necessarily regu-

lated by the position and intellectual and moral condition to which they have attained. It is too large a subject to enter now upon, but I am glad to find in the South, slaveholders who will speak out upon all the worst evils of the system and who are convinced that it must wear out, though it would have done so much faster if the course of improvement had not been arrested by interference and insults which have hurt the temper of many Southerners. Were it not for this unfortunate question, the free-trade feelings of these Southern States would be so strong towards England, that a war would be impossible. They have no love for the Northern ultra democracy, to which they ally themselves merely for protection against an apprehended interference for some scheme of speedy emancipation for which the blacks are not prepared; because the race cannot yet be reckoned upon for habits of continuous labour, which every savage, and his immediate descendants, has so great a repugnance to. The Northerners would not believe how attached many families here are to their negroes, and how it prevents them selling estates, when to do so would be both for their interests and tastes. I have looked into the statistics of crimes and punishments on this estate for thirty years, and wish that an average English parish could return as favourable results. Besides being clothed and very well fed, they are by nature most peaceful, so that they hardly ever fight, and the contrast of some Irish labourers who came here to dig a canal (to which, by the way, we owe the discovery of the Megatherium), would really be laughable if it were not such a serious evil. Mr. Hamilton Couper has written for the 'Geological Journal' from the beginning, and will be a subscriber for life. Others here will gradually come in, but it must be the work of time.

Believe me, my dear Horner, with love to all, ever your affectionate son-in-law,

CHARLES LYELL.

To His Father.

New Orleans: February 25, 1846.

My dear Father,—I have just been sending off a long letter, or paper, on the geology of Alabama, to the President, to read to the Geological Society.

I had to rough it a good deal in Alabama, but was well rewarded, both by the Coal-region and the Tertiary. I am now entering upon a new field, the great valley. I find everywhere much encouragement in the way of fellow-labourers, most of whom have either been educated in the more northern universities, or have migrated from the New England States on account of weak lungs. The unsettled migratory disposition of the inhabitants of a new country is quite curious. You meet with men, who with their wives have lived twenty years on one farm—improved it, grown rich on it, created it out of the wilderness, men without children, who are going to Texas. They have never gone first to see the promised land. If you enquire where shall you settle in that vast country, they reply, I shall go with my wife and negroes to Houston or Nachitochus, and then *look out.* 'Who never is, but always to be blest,' should be the motto of such landowners. I have seen nothing to alter my views of the condition of the slaves. If emancipated, they will suffer very much more than they will gain. They have separate houses, give parties, at which turkeys and all sorts of cakes are served up. They marry far more than our servants—eat pork—the women exempted from work a full month after childbirth, corporal punishment excessively rare; they do so much less bodily work than the whites in the North, that the Southern planters will not believe in the stories of the former. The other day an Alabama bricklayer returned from a New England apprenticeship and reported at Tuscaloosa that he had earned two and a half dollars a day by laying 3,000 bricks daily. As the strongest negroes are only required to lay 1,000, it appeared to the planter incredible.

Ever, in haste, your affectionate son,

Charles Lyell.

To LEONARD HORNER, ESQ.

Philadelphia: April 27, 1846.

My dear Horner,—The news which we received yesterday have given us so much grief on dear Harry's [2] account, and I feel so miserably our distance from him (which would be as great, however, if we were in Europe instead of here), that I have had great difficulty to-day to fix my thoughts on anything. I had some thoughts before my arrival here, to draw up a paper on what I learnt and observed of the important geological question respecting the proofs alleged to have been found of the existence of mammalia, birds, and reptiles in the Pennsylvanian Coal Field. But I cannot do this now, and until I have in town the slabs of sandstone which are on their way, and have had more time to make sections and maps, I cannot do the subject justice. Meanwhile, I shall not be sorry to give the Geological Society the news in any way you please. In a few words, I have satisfied myself that Dr. King is right in believing that he has discovered in the middle of the coal formation, the foot tracks of a large reptilian quadruped or animal allied to the Cheirotherium. These occur in one locality, and no others have yet been found in the same place, nor under similar circumstances elsewhere. The locality, which I visited, of the supposed bird tracks is simply a ledge of white coal-grit or sandstone, sculptured by the Indians, who have, I doubt not, intended to represent dogs (or wolves), birds, and other animals. Dr. King was a beginner in geology when he first found, and to his credit appreciated duly, the importance of the Cheirotherium tracks. He is a man of thirty years of age, and in an extensive medical practice, who has suffered some persecution, professionally and socially, for believing the world to be more than 6,000 years old, and avowing this at a Lyceum. He has been held up as an infidel by the President of a Catholic College, by some German Calvinists, &c. I have met with other proofs of similar illiberality from persons of

[2] His brother, Captain Henry Lyell, 'wounded severely' at the battle of Sobraon.

all sects, lay and clerical, in the United States, where the subject is much in the same state as in Europe.

The Cheirotherium tracks occur in pairs, each pair consisting of a hind and fore foot. There are two rows of these which are parallel, or have been formed the one by the right fore and hind feet, the other by the left, the toes turning one set to the right and the other to the left, and the distance between the successive footsteps being about the same throughout.

Few geologists will now be prepared to believe that this single species or genus of reptile, or that one class only of vertebrated animal, had possession of the islands and continents on which so widely extended and magnificent a vegetation flourished.

Tell Dr. Falconer to look out for some splendid teeth of Texas elephants which are going from New Orleans to London for sale.

Believe me, ever your affectionate son-in-law,

CHARLES LYELL.

To HIS SISTER.

[3] Steamship 'Britannia': June 11, 1846.

Dearest Carry,—The Captain declares we were at least three ships' length off the great iceberg which appeared suddenly out of the fog in the night of Friday, June 8. As we were going at the rate of ten miles an hour, the moon obscured by clouds and a thick fog, you may believe that Captain Elliot as a naval man, and better able than the rest of us to estimate the danger, was not a little excited at what he considers the rashness and inexcusable folly of not slacking the ship's speed. All these mails run on in this way, and will do it till the Admiralty interferes. Going three or four knots they could always turn in time for their broadside to hit the ice, and only receive a moderate bumping. As we passed fifty bergs or more in daylight, the Captain (one of the most cautious of the whole set) does not doubt that we were within pistol-shot of many which were not seen in the fog. They keep a bright look out, officers and

[3] Return voyage from America.

men, and are aware of the risk. But what folly, when they would only lose six hours of the night at most! One iceberg, almost the only one before dark which came close to us when I was below, had a large rock twelve feet square on the top, and much gravel and dark sand on its side. They were from 50 to 400 feet in height; pyramidal, pinnacled, dome-shaped, single-peaked, double-peaked, flat-topped, and of every form and most picturesque, and only a quarter of a mile off us, and numbers more distant.

Ever affectionately yours,

CHARLES LYELL.

To SIR PHILIP EGERTON.

11 Harley Street, London: September 26, 1846.

My dear Sir Philip,—I am very glad to know that Agassiz has really sailed at last, and when I knew of the 'Great Britain' going ashore, I could not help rejoicing that I refused him even the three or four days' grace he prayed so hard for in Southampton. The work he did when with you was really gigantic. All the while he was looking over the Connecticut fish you had named, he exclaimed how rejoiced he was to see you had named and separated them as he would have done, and that 'you will have in England while I am away, one to whom you may safely refer.' Of the homocercal (lias?) fish, I have duplicates, of which you may depend on having the first sight and pickings. C. Bunbury is drawing up an account of the accompanying fossil plants (oolitic forms) like those of the Whitby (oolite) coal in Yorkshire. I hope to get a description of the single species of fish from you, the only perfect one, and anything that you may have to say of his associate, the Tetragonolepis, of which unfortunately there are only scales in patches.

As to the Durham (Connecticut) fish which you examined, they have no plants associated, but I am very much interested to hear from Agassiz that the fish resemble most nearly those of *Autun*, a place I visited in 1843, and got some plants (psarrolites and ferns) and some few fish, rather fine ones though few, which I will show you. Now I begin most strongly to suspect that the fish called Paleonisci, but

which Agassiz agrees with you in thinking not of that genus, belong to a formation almost as old as the coal, if not upper coal measures, whereas the Richmond coal plants and fish are triassic. This will be the more interesting as you remember the bird's footsteps of Hitchcock belong to the same period as the so-called Paleonisci and Catopteri. By the way, I have a duplicate copy of Hitchcock's 'Geology of Massachusetts,' 2 vols., 4to., with plates of the bird's footsteps, which I could give you if you have room for the same in your library.

Believe me ever very truly yours,
CHARLES LYELL.

To LEONARD HORNER, ESQ.

London: October 9, 1846.

My dear Horner,—I mean to refer to your last anniversary address in my sixth chapter of 'Principles,' for the best *résumé* of the present state of the facts and theory of the coal. I shall send you copies of letters which I am writing to E. Forbes and Ramsay on their excellent papers. I think E. Forbes's reply to you about not citing my climatal theory sufficient. But as I claim to have first in my 'Principles' laid down the foundations of explaining the difficulties experienced in reconciling the doctrine of *specific centres* with the apparent anomalous position of many living plants and animals, viz. by showing that *since* the existing species came into being the land and sea had so changed, chains of islands disappeared, shallow seas turned into land, or into deep seas, this might naturally or ought to have been adverted to. Still more, my proofs referred to by Owen, in his Introduction, of the isthmus which in the Miocene period joined Dover and Calais. But do not suppose I am going to enact the character of the 'injured man.' I am in great good humour with E. Forbes's beautiful paper, and even his numerous citations of me, though he has missed my two most important claims, which I shall be glad of the President of the Geological Society setting right, and so will Forbes himself. I am very desirous of reading the Richmond papers when you are in the chair. What I learnt

of the fish from Agassiz will add to its importance very much—it is oolitic coal—but I have also learnt and shall treat of it in the same paper, that my fine collection of so-called New Red or Connecticut fish, are not oolitic, but much older, and they throw new light on the age of the bird's footsteps, if not of the true carboniferous reptilian. But I write enigmas, as I cannot enter into details.

Ever your affectionate

CHARLES LYELL.

To EDWARD FORBES, ESQ.

11 Harley Street: October 14, 1846.

My dear Forbes,—I have been reading your beautiful essay on the glacial epoch, and the origin of the existing fauna and flora of Great Britain, with the highest interest and pleasure, and think it one of the most original treatises, and so far as I have yet studied it (for I mean to read it again), one of the soundest as well as boldest that I have ever had the pleasure of perusing. Among many views which I never ventured to promulgate, from want of sufficient knowledge of the Mediterranean and British mollusca now living, but what I had nevertheless more than suspected from what I knew, was the probable contemporaneousness of the newest Sicilian Pliocene, and the drift; as I thought some of the northern species which were in the Sicilian bed indicated a chill in the sea there, though no erratics had reached so far. I am very glad to see you come out with that, and many other novelties which I am sure are new. Horner, I find, had remarked to you, before I had read a word of your paper, that he should have liked you to have made more references to my 'Principles of Geology.' I am not aware that they are mentioned, though you have cited me for many other papers most fully. I am perfectly aware that there is no one who is in the habit of doing more justice to any claim I may have in our science than yourself, and therefore I attribute to mere accident any omission you may have made in citing me, especially as I have no doubt you think the publicity of a work which has gone through six editions is enough to satisfy any man, and supersede

tedious historical details. I may, however, mention on this head, that on the Continent I gain no priority for any original views or facts which have only appeared in my 'Principles' and 'Elements.' When the Geological Society of France voted a sum of money to Archiac, to draw up a report on the progress of geology for ten years (1835 to 1845 I believe), he wrote to me to say that all treatises on geology were left out of such reports, as they were presumed to be compilations, authors taking care to take date for their discoveries in scientific journals, but as my book was an exception to such rules, he wished me to send him an exact list of all my original theories and facts, and their dates, which owing to their numerous editions no one could make out, and which he must neglect without such aid. I have not yet complied with this requisition, nor do I think I shall, but it makes it the more agreeable to me, when any able writer like Owen ('British Mammals') cites me, and gives the date of the earliest editions when my own views first appeared. I will now allude to some parts of my 'Principles,' and some of my separate memoirs, to which I think it would have been natural for you to refer, that you may take an opportunity on some future occasion, if you think fit, to acknowledge my labours.

To say nothing of my theory of the cause of fluctuation in climate, which although no eminent men have controverted it, none except Darwin have avowed their belief in, I will come at once to a grand truth of which your paper is a splendid illustration, viz. that 'zoologists and botanists were unable to refer the distribution of species to any determinate principles because they have usually speculated on the phenomena on the assumption that the physical geography of the globe has undergone no alteration since the introduction of species now living,' &c. ('Principles,' 1st Edition, vol. ii. Ch. II.) I explained De Candolle's difficulty of mountain chains sometimes being barriers to the migration of plants and sometimes not. I insisted on the fact that in Sicily the species of plants, shells, &c., the whole flora and fauna, were older than their *stations*, that they existed before the seas, hills, rivers, lakes, mountains, &c., were formed. I need not remind you of the entire chapters devoted to this kind

of argument, which so far as Darwin's and my reading goes, was new. I certainly did not borrow it, and no one had dealt with it systematically. As I assumed 'specific centres,' as you do, and endeavoured to remove many anomalies which beset the subject and explained how species may have migrated 'where islands since destroyed and submerged existed,' &c., and as I had so recently opened up this new line of research connecting geology and natural history, I think some brief notice, in a prefatory sentence, of my treatise would have formed a natural beginning to your grand working out of the problem. But I will now come to some of my papers which enter more specially into your own arena. I will first take one of my papers on Touraine, out of the order of date I believe, for I am writing this, as you will perceive, off-hand, in which I have endeavoured to prove, after carefully studying on the spot the fossil shells of the Norfolk and Suffolk Crag, and those of the Faluns, and compared them with each other, that a tract of land must have intervened in the Miocene period, between the regions of the Loire, &c., on the south, and the Orwell, Yare, &c., on the north. Owen has referred to this paper in his Introduction, when speculating on the isthmus between Dover and Calais. Murchison in an anniversary address alluded with wonder to my identifying the groups of fossil shells in Norfolk and Touraine as contemporaneous, when nearly every species was distinct. I had accounted for this difference in the species, not only by a geographical barrier like the isthmus of Suez, but also by the meeting of two different marine faunas in the same sea, one from higher and the other from lower latitudes, as Darwin had shown in South America. (See my paper, 'Magazine of Natural History,' July 1839.) In that paper the comparative northern aspect of the Crag shells is reasoned upon. But this subject is taken up more fully in my comparison of the Faluns and Crag, published in 1841 ('Geological Proceedings,' vol. iii. p. 437), in which memoir there are many passages which I think called for some acknowledgment, and among others, my proof from the terrestrial mammalia of adjacent land in the neighbourhood of the Faluns. The geologist might wish to know whether you doubted my Miocene east and

west barrier, or if not, whether plants would not have migrated by it into the south of England at an earlier period than that of your West of Ireland flora, No. 1. You may reply that such land may have had no connection with Spain, &c. I had made, as you know, the finest collection of Touraine shells, and had been aided by Searles Wood, as well as yourself and George Sowerby, in regard to my Miocene shells, besides getting the corals and fish, teeth, &c., determined. I traced the real Suffolk Crag to its southern limit in Normandy ('Geological Proceedings,' vol. iii. p. 438).

In my paper, read 1840 ('Geological Proceedings,' vol. iii. p. 171), on the Norfolk drift, I refer the disturbed stratification of the drift to the agency of ice, and I identify in age certain freshwater beds with part of the drift period, giving insects and fish and plants of that age. The fish are afterwards described, and I state that we must look northward for analogous types. Some allusion might have been made to these attempts to work out some of the dates of the modern fauna contemporary with *recent* shells.

In my 'Elements of Geology' I entered copiously on the phenomena of the glacial period, and insisted on the arctic character of the fauna, in which I may have been anticipated by Smith of Jordan Hill, though I had drawn the inference from Canada and Sweden before he published. In the list you give of the shells of the glacial epoch, you have forgotten my list of Canada shells (Quebec) given in my American Travels; thus, for example, *Mya arenaria*, *Saxicava rugosa*, *Cardium Groenlandicum*, *Scalaria Groenlandica*, *Littorina palliata*, are shells common at Quebec, and given in my list, to which you have not appended Canada as a good drift locality. I well know, however, how difficult it is to recollect all the scattered notices of any author, and quite impossible to find them in time for reference, even if you do remember them, and I imagine that none of us ever publish without giving some one the power of pointing out such omissions.

You speak in your paper of the mingling of deep and shallow water species of shells, a fact to which Dr. Fleming had often called my attention, as the effect of what he calls a ground swell, throwing up both kinds of testacea, littoral and

pelagic, on one shore. You hint at icebergs and northern waves. The former has no doubt had its influence, and when icebergs turn over, or fall to pieces, huge waves are caused not merely *from* the north. But it has always seemed to me that much more influence ought to be attributed to simple denudation where beds of loose sand, gravel, or mud were upheaved, and sometimes alternately depressed and upraised in an open sea. The exposure of such destructible materials must have led to the confusion you allude to, but much less so where the beds were protected in fiords, &c. The broken fossils found in these strata would agree with my denudation hypothesis, which is I think strengthened by the frequent regular re-stratification of the beds containing the deep and shallow water species.

I think your paper and Owen's Introduction have come out at a peculiarly opportune period, when Agassiz, Alcide D'Orbigny, and their followers, are trying to make out sudden revolutions in organic life in support of equally hypothetical catastrophes in the physical geography of the globe. Do not imagine that I shall in my new edition of the 'Principles,' or elsewhere in print, ever allude to the slightest regret on my part about any of the omissions of reference in your book which I have here enumerated. On the contrary, I shall take every opportunity of expressing the real admiration I feel for your paper, and of citing it in my first, second, and third books.

Believe me ever most truly yours,

CHARLES LYELL.

From EDWARD FORBES, ESQ.—*Reply to the foregoing Letter.*

Bala, North Wales: October 18, 1846.

My dear Sir,—Many thanks for your letter of the 14th, with your remarks on my essay in the Survey Reports. The kind spirit in which you have written assures me that you cannot consider I have sent forth that essay with any intention of being unjust, or of overlooking your great claims in any part of it.

My paper was written under very disadvantageous circumstances. It had to be prepared for the press by a certain

time, and no sooner had I commenced the preparation of it than the severe illness which laid me up last winter came on, and two months, January and February, were thus entirely lost. During those months I was confined to my bed. March only remained for the composition, and during that month, whilst very weak and by no means fit for work of any kind, I had not only to write the paper as printed, but also to prepare my course of lectures on Distribution for the London Institution, and to get my botanical lectures in order, for their commencement in April. The superintendence of Spratt's and my Travels in Lycia, now at length ready to come out, was also on my hands. Under such circumstances many references I should have liked to quote were lost sight of and omitted. I could not go about to libraries, and my own books are mostly still lying packed up in various places, as it is useless taking them out until I find myself in some more settled position. My only course under such circumstances was to write out my argument in my own way, and to back it by such references as were at hand, or as I had already taken notes of, when backing seemed to me absolutely necessary. The plan of my essay was purely *inductive*, and consequently did not admit of more citation than was absolutely necessary for my purpose. I had proposed to myself a *special* problem (the origin of the *British* fauna and flora), and in the working of it out had neither time nor space to draw up an *exhaustive* essay. I had to compress my argument into as small a space as possible. It was my wish to have appended notes and extracts in an appendix, and to have given a bibliography of the scientific literature bearing upon the subjects treated of. In this way I could have done the fullest justice to everyone who had touched upon them; but illness and the printers prevented the fulfilment of the intention. As you were away when I was at work, I have thought it necessary to offer these preliminary statements before replying to the special points in your letter. I shall now take them seriatim.

1st. You remark on my not alluding to the 'Principles.' There cannot be a warmer admirer or more grateful pupil of your 'Principles' than myself. I have read every edition, and most often over; and much that I have done has grown

up from the seed sown by you. My not quoting them oftener, however, is not an accident, but because I did not consider allusions to them necessary. I wrote for naturalists and geologists—who are, or ought to be, as familiar with them as myself. In all such essays as mine, it is impossible to refer except in very special cases or when the book or paper is supposed not to be familiar to the readers. What you say respecting the French does not affect this. It is part and parcel of the conceit of that nation to assume they have a right to put admitted truths, or sources of truth, aside. The idea of leaving out references to treatises on geology in a report on its progress is preposterous. In geology, as in the other natural history sciences, the last general treatise of acknowledged authority must always be the starting point in special essays, and its contents taken for granted, or else citations would be endless. At the same time the references you quote from the 'Principles,' especially that respecting the age of the plants and animals of Sicily, might have been most advantageously (to me) noticed—and would have been, had they not escaped my memory. I have not the book by me here, but when I get back will refer to them most carefully. I still look forward to (and am preparing) an Essay on the Origin of the Flora of the Levant, in which the history of the whole Mediterranean flora will have to be commented on. This will give me an opportunity of showing the value of your views on these points. On this subject I should like to have much conversation.

Now as to the more special papers. Your references to the Touraine and Crag papers are of the greatest consequence, and the quoting of them would have been strong supports to my argument. It would have made all those parts of my essay relating to the Crags much clearer and more satisfactory. But that part of the subject was kept as brief as possible, subservient to the main questions about the drift, &c. I had neither time nor sufficient *practical* knowledge of the Crags to warrant my adventuring farther than I have done, but look forward to future work in that direction. The same may be said with respect to your Norfolk drift papers. I could not have entered critically on them or the Touraine papers without doing so in the case of many other

valuable essays, by various authors, British and foreign—too many to cite consistent with my plan. This was also the case with respect to questions about action of ice, &c. As to the mingling of deep and shallow water species of shells, Dr. Fleming's explanation does not appear to me to apply in the cases referred to. When we meet, I will explain why.

The references to the Canada list of Pleistocene fossils were omitted in the table at page 380 by an oversight, but you will find them all inserted in the full list forming the appendix, and at the end of the appendix your name given as my authority.

One important point I have omitted to allude to, viz. your climatal views. I look on my paper in a great measure as a contribution towards this confirmation. But to have expressed a positive opinion on my part would have been of too little weight in the discussion.

You are pleased to compliment my paper on its *originality*. Any praise from you must ever be among the greatest gratifications to me, and to any honest labourer in the great field of nature. But I had rather hear the views I have set forward be proved *not original* than the contrary. It seems to me that the surest proof of the *truth* of such conclusions as I have summed up at the end of my essay is the fact of their *not* being *original* so far as *one* person is concerned, and of their having become manifest to *more than one* mind, either about the same time, or successively, without communication. I believe laws discover themselves to individuals, and not that individuals discover laws. If a law have truth in it, many will see it about the same time. Hence to me announcements of anticipations are confirmations of the truth of one's opinions, and welcome accordingly. In this spirit I have gladly perused your letter, and in the same spirit I feel sure you will regard whatever I have written or may write, worthy to interest you.

Ever, dear Mr. Lyell, most sincerely yours,

EDWARD FORBES.

To His Father.

11 Harley Street: November 26, 1846.

My dear Father,—I have got through half, and by far the most difficult half, of my new edition, and it gives me an interest in reading up my arrears of new geological papers which reconciles me to the deferring of my American second Travels. We went this morning to buy a dozen of knives for our dinner party on Monday. The old cutler in Oxford Street said, 'No. 11 Harley Street; I remember well the house, eleven doors on the right hand from Cavendish Square, for I went there with knives to the Duke of Wellington, then Sir Arthur Wellesley (thirty eight years ago), for he lived there.' Old Mr. Rogers, who with the Milmans dine with us on Monday, to meet Charles Bunbury and Frances, will, I daresay, be able to tell us of Sir Arthur in this quarter. Macaulay was most entertaining at Milman's last dinner, giving and taking, and not overpowering. He is hard at work with his 'History of England.' I asked him if he had read 'Constantinople,' in the last 'Quarterly Review.' He said, 'No, but all about St. Chrysostom is got out of the edition of his works, which I read at Calcutta, and ended by liking the old saint, which is more than one can say of most of the old Fathers.' Milman remarked, that at Oxford such high prices are no longer obtained for editions of the Fathers or Puseyite mediæval books, but they are selling at Cambridge. A few days before, Herman Merivale told me he had heard the same, and that there was an extraordinary spread of scepticism and rationalism at Oxford. In large parties, men holding forth that as a high admiration of the beauty of form was the characteristic of the Greeks as a nation, so the Jews had the religious instinct very largely developed, and hence they developed Judaism, Christianity, &c. To get back to Dean's Yard, Milman was talking of the fortune he could have made if he had had the gift of prophecy for five years, as, when he came to Westminster, whole streets of houses were offered him for a fifth of what they let for, when railway companies were bidding for offices near the Houses of Parliament, &c. On which Macaulay, recurring to the former talk about Chrysostom said, 'But think if one

could have bought up the Fathers at their value in 1800 (when they were fairly appreciated), and sold them at the Oxford price of 1840!' Some one at the other end of the table, where there was a dish of larks, was talking of the destruction of life, such small birds, when Macaulay said, 'On that principle you ought to feed on blubber.' Would not old Dr. Johnson have just said that, if Boz had been sentimental? Lord Lansdowne was in good spirits, but the great affair of the Education Bill being put on him, evidently makes him feel as the old man. Kay Shuttleworth, who dined with us, is his right-hand man in that, and to him we shall be, I hope, indebted for some good plan of national education. George Lewis, the much-abused poor-law commissioner, was very agreeable. Ever since his article on serfdom in the 'Edinburgh,' last spring, I have thought more highly of his talents, which we always knew to be great. Lewis was talking of the ancient Britons not trying to convert the Anglo-Saxons because they despised them so much, and thought they might as well go to the devil their own way. Macaulay said, 'Would the Saxons have gained much, being such respectable Pagans, and the Welsh such superstitious Christians?' Henry Drummond (the saint), when Cunningham (of Harrow) tried to convert Byron, said, 'It was better to be an infidel such as Byron, than such a churchman as Cunningham.' Milman talked of Talfourd's dismay when his 'Ion' was published entire in a Calcutta newspaper, and called 'John.' Alison's 'History' was spoken of, and his blunder of calling the French 'impôt des timbres,' the timber duties. I wish the accounts from Kinnordy could make me feel more cheerful about my mother.

With our joint love, believe me, my dear father, your affectionate son,

CHARLES LYELL.

To HIS FATHER.

11 Harley Street: December 16, 1846.

My dear Father,—Eleanor's letter to Mary, and yours to me, arrived at very unusual hours of the day, and I suppose the

railway punctuality has been disturbed by the snow. I assure you I expected no answers to my letters, and if they ever give any amusement to the party at Kinnordy, it is a pleasure to us, and a very poor contribution towards our share of cheering the winter there,[4] where so many are proving themselves such excellent nurses. I can hardly remember enough of Mary's letter to be sure I may not make some repetitions of our three very agreeable days at Bowood, but I will add a few of my remembrances. Nothing made the whole visit more agreeable than the perfectly equal part that most of the guests played in conversation, which was lively and well worth listening to. It is too often the case in such society, that some one gets an undue monopoly, not so much from a desire to shine, as from exuberance of ideas and spirits, as was remarkably the case with Sydney Smith, and even Rogers in his better days when I first knew him, and is now with Macaulay and Lord Jeffrey, and occasionally even with Hallam, but never with Milman, though his talk is of the very best. One day Lord Lansdowne asked Lord Clarendon what the Pope was originally. He answered, 'He wanted to go into the imperial guard and be a soldier, but they would not have him because he had been epileptic.' 'Then,' said Milman, 'he may make, perhaps, the fourth great epileptic hero;' Julius Cæsar, Mahomet, and Napoleon being the three others. They were talking of Sydney Smith, and how he never talked of his mother, whereas his brother, Bobus Smith, was so fond of dilating on the excellences and extraordinary beauty of their mother. On this Lord Lansdowne said one day, he (Bobus) bored Talleyrand so much with that theme in London, that Talleyrand said, 'C'étoit donc monsieur votre père qui étoit si laid.'

Mr. Greville had learnt from Harness about my reptilian footsteps from the Pennsylvanian coal, and as his brother-in-law, Lord Ellesmere (late Lord F. Gower), had been recently taking up slabs of Cheirotherium footsteps in the New Red on his property, he (Mr. Greville) was curious about them, and wanted to know the antiquity I ascribed to them as compared to the Megatherium. After the ladies had retired they fell to in earnest on the whole subject, and after I had

[4] His mother and sister being laid up with illness.

given my views, Milman explained how writers of research and reputed orthodoxy in the English church, had adopted, some the Hebrew, others the Septuagint, others the Samaritan chronology, and how that of St. Paul differed from that of Moses, and on the whole, how they varied 2,000 years from each other. After his very clear exposition of the case, Lord Clarendon, who had never, I think, read or thought much on the point before, observed, 'It seems then, that the geologists are blamed for not making their notions of the world's age agree exactly with a chronology (supposed to be Scriptural), which we really know nothing about.'

One day at dinner I was telling Milman that Pius IX. had not only encouraged the scientific professors of the Roman States to attend this year's congress of 'savans' in Italy, but another (the next I believe) was to be held at Rome. 'Yes,' he said, 'and the British Association is to meet at Oxford with Sir R. Inglis as president. Inglis and the Pope; no wonder people are fearing that Oxford and Rome are approximating too nearly. And both of them, after opposing railways, are adopting them.' Lord Clarendon told a good story of the last papal election, but I cannot remember the names. Cardinal A., who was ambitious of mounting the papal chair, asked Cardinal B. who he thought would succeed. B. replied, 'If, as we are given to understand, the Holy Ghost directs our decisions, I think it will be either Cardinal Chigi or Ferretti (the present Pope), but if, as some think, the Devil meddles with the election, I shall not be surprised if the choice should fall to your Eminence or me.' Within five or six miles from Chippenham, through Calne or Bowood Park, to the summit of the chalk downs, which are visible from Bowood, there is a beautiful geological series of formations exposed, ranging from the Bath Oolite to the chalk. By going one way and returning another, I was able in a few hours to give a good field lesson to a party of three; they were apt scholars, and I was very glad to explore the country myself.

Ever your affectionate son,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

11 Harley Street, London: December 26, 1846.

My dear Ticknor,—I shall begin this letter some days before the next mail, that I may thank you for your last, which interested us much, especially your account of the inhaling the ether, of which many successful experiments have already been made in the hospitals here, and about which everyone was anxious to know, and knew not how much to believe. Sir J. Clark and Dr. Boott learnt from your statement, which Mary gave them when she met them one day, the first precise account of the longest time (seventeen minutes) that the effect had been prolonged without injury. We have been reading Dana's 'Two Years before the Mast,' a delightful book; it is so rare to get a clear insight from an educated mind of what life really is in a humbler grade among the working classes. Is he getting on as a lawyer, and has his health never suffered from his voyage? When you introduced him to me he seemed quite well. I believe I mentioned to you in my last letter that we were going to pay a visit at Bowood, at Lord Lansdowne's, in the country (Wiltshire) of a few days. It turned out a very agreeable holiday. The party were Mr. and Mrs. Milman, and Mr. Harness, Lord and Lady Clarendon (he is now President of the Board of Trade), the Chancellor of the Exchequer, Mr. Wood and Lady Mary Wood (she is a daughter of Lord Grey, and a very pleasant person), Mr. Charles Greville, author of an excellent work on 'Ireland,' Lord Devon. I had much talk with the President of the Board of Trade on American affairs, on which he is well informed, and has liberal and statesmanlike notions, without prejudice. Indeed the freedom from that upon this subject is, I think, singularly in proportion to the more elevated station in society which men occupy here, which is more than some would have expected between a democracy and aristocracy.

Mary showed the daguerreotype of Mr. Prescott's bust to Lord Lansdowne, and they think that none have been as well executed here, and Lord Lansdowne wished Mr. Prescott would make haste and come to England, in which the others joined. The Milmans were in good health and spirits. Tom

Moore was asked, but did not come. One day Lady Lansdowne gave me an Irish car to myself, and I gave Milman, Lord Clarendon, and the Chancellor of Exchequer a regular field lecture, taking them from 'the oolite to the chalk downs,' into which they entered with great spirit, especially the two ministers, who wanted to forget the state of Ireland, growing as it does every day worse and worse. I send you a letter I was induced to send to the 'Times'[5] (the first time I was ever guilty of such familiar intercourse with the public press) in answer to innumerable inquiries on the subject, some of them from your side of the water. Dr. Gould will, I think, be glad to see it when you have read it. I am glad to hear that Agassiz saw so much of Gould, and appreciated, as he could not fail to do, his profound knowledge of zoology.

Believe me, dear Ticknor, ever most truly yours,

CHARLES LYELL.

[5] On the alleged co-existence of man and the Megatherium.

CHAPTER XXV.

FEBRUARY 1847—SEPTEMBER 1848.

ANNIVERSARY OF GEOLOGICAL SOCIETY — EDITORSHIP OF 'EDINBURGH REVIEW'—CALL ON ROGERS—HIS REMARKS ON HISTORIANS—BREAKFAST WITH HIM—CHAPTER ON UNIVERSITIES IN SECOND TRAVELS—RARE BOOKS—BRITISH ASSOCIATION, OXFORD—LINNÆA BOREALIS—DECAY OF THE DRAMA—HUGH MILLER'S 'FIRST IMPRESSIONS OF ENGLAND'—VISIT TO BOWOOD—PARTY AT SIR ROBERT PEEL'S—MEETING AT ROYAL SOCIETY—KNIGHTHOOD—DINNER WITH THE ARCHBISHOP OF DUBLIN.

To His Father.

11 Harley Street: February 21, 1847.

My dear Father,—I have been so much occupied since I got my book off my hands with arrears which had accumulated, that I have not given you any account of our scientific anniversary of the Geological Society when the first, and only copy yet out of *the book*, was laid on the table as a present to the Geological Society, and really looks better than you might expect a condensation of three into one to do, the print being respectably large. Horner, to whom as President of the Geological Society I have dedicated my seventh edition, got great credit, as he deserved, for his two years' services to the Geological Society. Sir H. De la Bêche, the new President, was supported by Lord Morpeth, who spoke with his usual eloquence, and after him Bancroft made a very good speech, ending with saying he had obtained leave to give my health. So I was called up very early, and told them my last news from De Verneuil and Agassiz, both foreign members of the Geological Society, and who having both visited the United States since I returned from America last spring, had given us as flattering an account of their reception, and the number of congenial enthusiastic minds they had been in contact with, as I could have done. I amused

them by narrating what De Verneuil had said to me, when I asked him if he was not struck with the reigning idea which cheered one in travelling in that country: progress, progress. 'Yes,' he said, 'your information is quite antiquated; it is six months old. You have only seen the railroad penetrating westward 300 miles, through forests and morasses, but I have seen the electric telegraph extending beyond the termination of the railway; the wires attached to the trunks of trees from which the boughs had just been lopped off, and the news carried with the speed of lightning to villages and towns which have never yet seen a locomotive engine.' The Bishop of Norwich spoke well, though some might have been less pleased than we geologists to hear him wish that 'they who differ but in a little in theological matters, would only live in as great harmony with each other as he saw scientific men do, who differed so widely in their theoretical opinions on many points, which they could discuss, as we did, without quarrelling, and cherishing, as became Christians, the unity of spirit and the bond of peace.' Poor man! he has enough of it in his diocese, although he has not, I believe, been of late personally embroiled in the ecclesiastical disputes that divide many of his clergy. We are glad to have the Bunburys with us. 'The fresh woods and pastures new,' which you congratulated me upon now enjoying, consist of my joint paper with Charles Bunbury, on the more modern or Oolitic Coal and Coal Plants of Chesterfield County, near Richmond, Virginia.

Ever your affectionate son,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

11 Harley Street: February 23, 1847.

My dear Ticknor,—We were glad to receive your kind letters from Park Street, with one, long looked for, from the Hamilton Coupers from Georgia, and others from MacIlvaine, Miss Wadsworth, and other friends, which took us back very pleasantly to many of the points where we spent our time most agreeably a year ago. At a dinner at Hallam's the great subject was the vacant editorship of the

'Edinburgh Review.' Macvey Napier having died, Hallam and Milman had for years thought they had better bring the 'Edinburgh' up to London, as most of the contributors in these days live south of the Tweed. Longman the bookseller had been closeted with Macaulay for hours, consulting what could be done, the pecuniary and political stake being considerable. They had at first thought seriously of a Mr. Rogers (no relation of the poet, and I believe a clergyman), a contributor to the 'Review' of many able articles of late, on 'Puseyism,' 'Leibnitz,' and in the last, 'Pascal.' Lord Jeffrey was much opposed to the editorship leaving 'Auld Reekie;' but yet they talk now of his son-in-law Empson being editor, who has a professorship of law in the East India College, near London. He wrote the long article on 'David Hume' in the last. The article on 'Ragged Schools' in the 'Quarterly Review,' of which you inquire, is by Lord Ashley, who has gone practically and personally into the investigation. Milman wrote the other, on 'Popular Education,' which I am glad you approve of as much as we do. The article on 'Centralisation' in the 'Edinburgh' is by John Austin: they tell me it is 'good, but dry.' I remember when Lord Melbourne was considering the best way of dispersing a mob which they were anticipating, Sydney Smith recommended him to get John Austin to go and read them a chapter out of his 'Jurisprudence,' then just published.

We were discussing the other day the effect which it would have here in modifying religious intolerance, if the social and educational equality of the different sects were greater, which made me wish to know from you, as a matter of fact, whether any literary man or woman in Boston, whether of the Episcopal, Presbyterian (Calvinist), Romanist (if any there), Methodist, &c. &c., lived through the days of Channing's greatest celebrity as a preacher and writer, without, once in a way, and many of them oftener, going to hear him preach. I apprehend that the effect of such occasional interchange of churches, even where rare, is not only to make part of a congregation see that there is some good in the leading men of other sects (at all events that they have not horns and cloven feet), but that the controversialists who teach a flock, who have access to their opponents' argu-

ments orally delivered, are more cautious and exact in what they say themselves. Bancroft made a good speech at our geological anniversary.

The education scheme here is crippled by the bottomless pit of Ireland, but is ripening and expanding the teaching of *schoolmasters*, more and more determined on as indispensable. But they are deplorably behind Boston.

Believe me ever most truly yours,

CHARLES LYELL.

To HIS FATHER.

11 Harley Street: March 5, 1847.

My dear Father,—I hope you will get this letter on your birthday, of which Mary and I wish you many happy returns; and beg you to accept from us a print of Paris, which recalled to our memory in a bird's-eye view all the leading features, and streets and gardens and boulevards, of that beautiful city most vividly.

I am busy writing a paper on the more modern Coal Field near Richmond in Virginia, and spent a good day yesterday in my museums here with Sir Philip Egerton, who has named my fossil fish for me, on which subject he is quite an authority, founding new genera and species which are generally adopted in Europe. We had a pleasant call at Mr. Rogers', whose sister is recovering from her fall. We found on the old man's table a speech of Charles II. to his Parliament, printed in 1661, in bad English, which he observed could never have been shown to Clarendon. Alluding to Macaulay, he said 'he had found him once writing a review with five folios open, each on separate chairs, but unfortunately, though conscious that the article would be known to be his, he was writing with that confidence and rapidity which if he had had to sign his name at length to the pages, he would not have presumed to do. Such was the unfortunate tendency of anonymous historical literature.' He then repeated, what I had often heard him declare, that Hallam wrote history as a judge and Macaulay as an advocate, and he blamed the latter for giving a set-down to Charles Fox's 'Life of James II.,' for which Samuel Rogers stood up man-

fully, taking the book down from his shelf, and, without spectacles, pointed to three or four of his favourite passages.

Mary sends her love and best wishes; and with love to all the family, believe me, my dear father,

Your affectionate son,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

London: April 2, 1847.

My dear Ticknor,—We had a very agreeable breakfast the other morning with Mr. Rogers, in his eighty-fifth year, and though he is now often tired at dinner after the society of the morning, I never knew his mind more vigorous than it was. The party, besides ourselves, were the Bishop of Norwich and his wife Mrs. Stanley, both original and pleasant people, and the Bancrofts. The old poet took pains, as the Bancrofts were there for the first time, to do the honours of the house and pictures well, and often as I have heard him, it was most of it new to me. He has a very spirited reduced picture by Haydon, of Napoleon on the rock overhanging the ocean at St. Helena, the back turned towards you. I like it better than the one which I have seen at Peel's, at Tamworth (Drayton), which is as large as life; too large. This gives us all the sentiment, which was much heightened to us by Rogers, who you know is an excellent reciter, repeating some lines of a poem by Lyte, a Devonshire clergyman, written when the French first asked leave to remove the ashes of the Emperor from St. Helena.

Disturb him not, he slumbers well
  On his rock 'mid the western deep!
Where the broad blue waters round him swell,
  And the tempests o'er him sweep.
Disturb him not, though bleak and bare,
  That spot is all his own,
And greater homage was paid him there
  Than on his hard-won throne.
Earth's mightiest monarchs there at bay
  The caged lion kept,
For they knew with dread that his iron tread
  Waked earthquakes where he stept.

On my asking if he could show me the whole poem of Lyte's, he took an album from a drawer, where it was pasted in,

cut out of a newspaper, and as he gave it me, he said something in his caustic way which I cannot report correctly. 'When men have hit on a dozen good lines, they must always dilute them with a hundred weak ones.' In fact I found a long set of verses, from which, not all from one place, he had skilfully culled the best. After he had told the story of Chantrey having come as a workman at five shillings a day to receive orders for the ornamented woodwork of the table in the middle of the drawing-room, Mary happened to say she had never seen Addison's table, on which he wrote the 'Spectator.' S. R. went for it, for it is too plain and simple to accord with the rest of the furniture. Opening a drawer, he took out Addison's works, and read his dedication to Craggs, where he speaks of his desire that the memory of his writings should not outlive that of their friendship. 'A compliment,' said Rogers, 'which is the more pleasing when we recollect, which few do, that three days after he penned the dedication Addison died.' S. R. was describing some picture to Mr. Bancroft and Mary, while Bancroft was still at Addison's table with the book. I asked him, as he had been so often at the Abbey lately, and in Poets' Corner, if he could help me to the last two verses of Pope's Epitaph on Craggs. It is nearly thus, said I:

> He missed no public, served no private end,
> He gained no title, and he lost no friend.

But 'missed' is certainly not the word. Afterwards, when at home, I had turned up Pope, and read 'He broke no promise,' &c. There was some talk of duelling in the United States, and the usual explanation that the North is not the South, and that John Bull must try and learn to draw a line between the New Englander and the Southern chivalry. Upon which Rogers told a story which was the more laughed at because the ladies hardly knew whether they ought to laugh, and which I think the old gentleman told expressly to Mrs. Bancroft to try whether she had any of the reputed prudery of the Northern lady. He remembered an acquaintance going out to fight one Dr. Humphrey Howard, and seeing that his antagonist had no garments on, sent his second for an explanation. H. H. replied, that being a surgeon he well

knew that a bit of cloth carried into the flesh by a bullet would make it fester. The other declined shooting at a naked man, and so it ended. 'And if ever,' said S. R., 'I am called out, I am determined to adopt the same costume.' There was some talk of prose translations of poetry; Rogers in favour of them, wishing the 'Iliad' had been well done into prose, 'though I provoked Milman by saying so, and he declared he had made a vow never again to read any prose version of any poem.' 'You make no exception?' said I. 'None whatever.' 'Then we shall never hear you again read the Book of Job, or the Psalms of David, in our ordinary version,' said I. Empson has undertaken the 'Edinburgh Review' after all. They talked of Rogers. 'Is he not a dissenting minister at Birmingham?' 'Yes, and evidently a man of first-rate talent; but how do you know that they did not mean me, when they talked of Rogers as editor?' 'You have written reviews?' 'A few. One on Carey's "Dante," and Moxon the publisher said I caused the sale of 2,000 copies immediately. Another on "Joanna Baillie," when I called her several times "he" and "him" in the course of the article.'

I am much obliged to you for what you told me in your letter about Channing's works, and their sale, and Dewey's 'History,' and we read in consequence with still greater interest Channing's powerful discourse on the occasion of Jared Sparkes' ordination. There is nothing which people here so overrate as the relative proportion of the Unitarians as compared to the population of all other sects in Boston, and still more in New England, while they equally underrate, I suspect, the influence which the writings of the American Unitarians have exerted and do exert both in the United States and in this country.

As to Mexico, one cannot but feel what Madame de Staël said about *nations*, 'that nations always deserve their fate, whatever that fate may be,' although it is no apology for those who think it is 'our destiny' to be conquerors and the instruments of fate. Few here have any idea how much colonisation will be promoted in California, and what great results must come of this movement.

My University chapter in my 'Travels' has been much

read here the last few weeks, and cited as authority in pamphlets, there being a stir for reform in higher as well as lower departments. Whewell has prepared a scheme for Cambridge reform which I have not seen yet. The other day Baron Stockmar, who is so much about the Prince (now Chancellor of Cambridge by a small majority on the poll!!), told me at a party 'that Bunsen had set him to read my *temperate* and *manly* article on the "Universities," by which he and Bunsen had learnt with surprise that abuses which they had attributed to Romanist times dated chiefly from Protestant ages, and were therefore less excusable.' Nothing, I find, surprises our University men themselves so much as to learn, *inter alia*, that whereas under Roman Catholic rule the principal teachers of academical youth married and settled at Oxford and Cambridge, all those who now really and efficiently engross the educational function are enjoined to celibacy.

I am making it a matter of conscience to get out what Lockhart calls my 'Greywacke,' and which he and the public generally skip, before I indulge in other matters; but if you can tell me anything about the pay and station of your schoolmasters of schools for the many, by which I can compare them to ours, I shall be glad. I know how many complaints there are in New England of teachers being underpaid, yet I fancy they are in affluence when contrasted with ours. I should also be glad to know about the foundation and endowment of the new chairs lately founded, or according to Gould about to be created, for science in Harvard University. Whewell has replied to my chapter on our University system, and he has also written me a private letter of remonstrance the other day. I am going to take a day or two to write a reply in full, of which I will send you a copy, which I shall be glad that Everett should read, as some of the statements by Whewell had made some impression on him; but he will see that I was right. Indeed public opinion is rapidly strengthening. There is a move now in the right direction; but the clerical influence arrayed against all progressive sciences, whether physical or literary, is too powerful to be easily overcome. My University chapter has been praised of late in quarters where three years ago it

would have acted as an exclusion from society or good fellowship.

The moment I mentioned to Hallam, some weeks or a month ago, that England was the only country that had not conferred some public honour on Prescott, he said they usually waited till some friend took it up. Shortly after he told me, that he and Lord Mahon had immediately proposed him at the Antiquaries, the oldest body, after the Royal, which is for 'natural knowledge' exclusively. In due time he will be elected, and will have the privilege, as explained in one of the old farces, of appending A.S.S. to his name as being of the Antiquarian Society a Socius.

Dr. Gould's letter of enthusiasm about Agassiz is very refreshing, and shows that Channing need not have been so severe on the atmosphere of Boston, as repressing all such feelings, or the expression of them.

As to Agassiz saying the negro's brain is like a child's fourteen or sixteen years old, if I am not greatly in error, Owen says the same of the adult male stolid and uneducated agricultural labourer. Tell Agassiz this, and see if it is new to him. On our recent fast day, the charity children, the youngest down to four years old, had to go to church, in many parishes three times; service two hours, and an hour and a half. Is there any persecution of the young perpetrated in New England on Sundays or other days of this kind?

But I must conclude. Believe me, dear Ticknor,

Ever most truly yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

London: May 3, 1847.

My dear Ticknor,—Nothing which you have told me gives me greater hopes of the future than your account of Mr. Hillard's lectures, *and his class.* Pray tell me all such news. Mr. Hallam, when we breakfasted with him, was giving Mr. Winthrop an account of the sums paid for rare books by the Americans, one of whom bought at a sale the Mazarine Bible for 500*l.* (sterling) the other day. Sir Thomas Phillips told this to Hallam, who remarked that

according to the old proverb, there must have been two fools at that auction. 'Yes,' said Sir Thomas, 'I was the other; I bid against him.' Milman said that Sir Thomas could not have paid, so perhaps he was not such a fool after all. You see that Sir Walter Scott is dead. So ends that title, which one would have liked to have seen hereditary, if any. Lockhart looks ill.

Read Hugh Miller's 'First Impressions of England,' &c. I hope to send you a copy of my letter to Whewell by this post. Beg Mr. Everett to read it, and tell him I have an answer from Whewell which is quite a knock-under as to every disputed fact, and extremely pacific.

With my love to Mrs. Ticknor and her daughters,

Believe me most truly yours,

CHARLES LYELL.

To HIS FATHER.

11 Harley Street, London: June 25, 1847.

My dear Father,—I went down on Wednesday morning by the 10.0 express train to Oxford,[1] most of the time at the rate of a mile a minute, and our party, consisting of Milman, Bancroft, Grove, and myself, conversed easily, and it was certainly a magical transfer from place to place. It seemed strange to find Richards rector. I first encountered my old Swedish friend, of Lund in Scania, Professor Nilsson, who told me 'he was very unhappy, having lost his coffer' (alias portmanteau), which with his broken English he could not recover. So I made a stir, and found it at an inn. He then showed me what he considers conclusive evidence of man having co-existed with *Ursus spelæus* and other extinct mammalia in Scania. Though not quite satisfactory to me, it is the best proof I have seen; he had his fossil teeth, bones, arrow-heads, &c., with him. I then met in the Theatre Whewell, Peacock, Conybeare, Buckland, Adams, Faraday, Owen, C. Darwin, Bishop of Norwich, Chevalier Bunsen, Sir R. Inglis, Murchison, De la Bêche, Sedgwick, Sir J. Richardson, Wheatstone, and many others with whom I spoke. I called on Mr. Cary, but found him overwhelmed

[1] Where the British Association was held.

with law business in the Vice-Chancellor's Court. He spoke of your present of your 'Dante,' &c. As Darwin was lodging with the Jacobsons, I called with him, knowing Mr. Jacobson, who is Vice-Principal, I think, of Magdalen Hall. After I was gone, Darwin, seeing my 'Travels' on Jacobson's shelf, asked him how my University chapter had been taken at Oxford. He said, 'Extremely well; much read, and considered very temperate, and full of proofs of my having thought deeply on their system, and that he had heard many who differed from it *in toto* praise it.' I found on my table many cards of Exeter men, now become fellows, &c. The first day I dined with Baden Powell, who has married my friend Captain W. H. Smyth's daughter, to meet Sir John Herschel and Sir James and Lady Ross. I learnt much of the Antarctic expedition; some very wonderful new facts about the temperature of the very deep parts of the sea. In the evening we had an immense party at the Botanic Garden, at Dr. Daubeny's, where I was introduced by Sir Thomas Acland to his son, now Professor of Comparative Anatomy, and who takes all my views of the reform required in their system. Trevelyan, who was there with his wife, tells me he is one of the cleverest of the scientific Oxonians, and will be very distinguished. Young Buckland had a young bear, dressed up as a student of Christ Church, with cap and gown, whom he formally introduced to me, and successively to the Prince of Canino (Charles Buonaparte), Milne-Edwards, member of the French Institute, and Sir T. Acland. The bear sucked all our hands, and was very caressing. Amid our shouts of laughter in the garden by moonlight, it was diverting to see two or three of the dons, who were very shy, not knowing how far their dignity was compromised. Next morning I breakfasted at New College with Mr. Philip Duncan, a large party in Hall, most of whom I knew. The Dean of Winchester and some I had seen at Southampton in September were there. I then went and spoke at some length at the Geological Section, on what I had seen of 'raised beaches' in North America, on the Canadian Lakes, and in the valley of the Seine, subjects on which Robert Chambers (author of the 'Vestiges') read a paper. Sedgwick spoke well, and Professor James Forbes of Edinburgh,

and Darwin. Dalby was with us in the omnibus for a stage, and he and the sub-rector and my friends Darwin and Major Clarke had had a luncheon dinner together in the Common Room at Exeter before starting.

I left at six o'clock. With me in the coach was Dr. Twiss, who had been active on Cardwell's committee, and whose indignation at the conduct of even the more moderate party at Oxford was at the boiling-point. How extremes meet! I really might have thought that some one of my New England Whig friends was complaining of the ultra democrats reducing them to mere delegates, and destroying all free agency by requiring so many pledges as to future votes. It was not enough to go into all pending questions, but they put several hypothetical queries as to possible measures of future Government; as to educating or endowing Roman Catholics; and declared the answers not specific enough, and so drove him to retire; and now Round is said to have the best chance, and Maynooth and the Corn Bill, which the Cardwell party had hoped were dead and buried, and in the tomb of the Capulets, are to make the University, as Milman says, 'totus teres atque *rotundus*.' Inglis (who is quite a star in the House compared to Round) being so sleek, fat, and good-humoured, and on such good terms personally with all, even those who regard him as the parliamentary representative of the prejudices of the age, is truly the *totus teres*. Out of twenty-four heads of houses, only four at Oxford to receive the Association! But it will go off the better by the absence of the lukewarm or the hostile. I spoke to Hallam, Ehrenberg, and a great many others. Mary will tell you, I hope, of the Lansdowne House party; my eyes are so much better now that I enjoyed it much. I was glad at Oxford to see more of Ruskin, who was secretary of our Geological Section. I like him very much. If you have not seen his book on 'Painting,' you will be able to do so at Kinnordy. I have borrowed it of Susan.

Believe me, my dear father, your affectionate son,

CHARLES LYELL.

To CHARLES BUNBURY, ESQ.

Kinnordy: July 27, 1847.

My dear Bunbury,—The prospect of the Cape Journal coming to light is to me a great source of pleasure. I found your *Linnæa borealis* with more than *a hundred flowers* in full blow in the first week of this month. Some shoots, eight inches further from the centre of the patch than last year, and I think I have reckoned backwards that thirty years ago it might have been sown by a bird, but is probably older. Under a hot sun, the almondy scent of the flowers is very strong and delicious; after rain there is no odour at all. The day I last wrote to you I was going up the Clare Hill. I saw there, and took, the northern butterfly *Polyommatus Artaxerxes*, which I had never seen (Lepidopterist as I am) on the wing before. Our fairy ring is of larger diameter annually.

In haste, and with love to Frances, believe me, my dear Bunbury, ever affectionately yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

Kinnordy: August 25, 1847.

My dear Ticknor,—I am now fairly through my principal geological papers, one of which, of some length, on the Coal Field near Richmond, is just printed, with illustrations of the fossils I procured there. In looking over my notes nothing surprises me so much as the activity and progress, and the intellectual excitement and promise for the future, which I saw in so many parts of the Union, and of which there is here such an inadequate appreciation, and a kind of dogged incredulity which nothing but an array of statistics will disturb, coupled with the evidence of an eye-witness. In spite of the multiplication of steamboats and newspapers, and complimentary speeches to Winthrop and Bancroft at public and private dinners, John Bull is in general in a state of wilful blindness as to what is doing on the west side of

the Atlantic, and he will wake up some fine morning, and hardly believe his eyes when he beholds the *white* population equalling his own, and the number of those who can and do read and write twice as great. I remember when first the French Chambers began to discuss the first principles of a representative government, the English were astonished to see how many things even the highest Tories had been accustomed to take for granted, and how much they had inherited as a prejudice which they of the old *régime* in France deemed revolutionary. Pray let me have letters from you on the evidence of the advance of the educational and literary and scientific cause when the spirit moves you. When I was first at Boston all theatres were shut up; now you have several. Are any steps taken to render them less objectionable in the eyes of those people who in England regard them as corrupting and loose in their morality, from the bad selection of pieces acted and the character of the performances? I fear that circumstances do not favour in New England what one would wish to see—the converting the theatre into a place of refined intellectual culture, holding the same rank in that line which a philosophical lecture-room does in science, or a church in matters of religion. Is not this decay of the drama a strange anomaly? If the mere music and show, and costly scenery of our modern melodrama, to which crowds go, had been mediæval, and the acting of 'Macbeth,' and the writing of it had belonged to this age, would not this have seemed to you more in the natural order of things? Song charms the sense, &c. De Verneuil told me, and I repeated it at a public dinner in London, much to the edification of my scientific friends, that when they had extended the electric telegraph to the extent of the railroad, they carried it on from one tree to another in the aboriginal forest on trees from which the boughs had been lopped off. It gives a lively image of going ahead, which no Frenchman could have invented, least of all our quiet friend de Verneuil. Could you learn from one of your Boston law friends, whether in old colonial times the business of barrister and attorney was separated in New England, as it has always been in this country, or whether the union of the two grades was made to suit a more demo-

cratic constitution. We suffer, in my opinion, from this marked line of demarcation.

Ever, my dear Ticknor, yours most truly,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

11 Harley Street, London: September 26, 1847.

My dear Ticknor,—Perhaps you have seen some notices in the 'Athenæum' of a book by Hugh Miller called 'First Impressions of England and its People.' Do read it, as we have been doing. He is the editor of the 'Witness,' Free Kirk newspaper, has risen from being a common quarryman to be one of our best writers. If you are now and then startled at the inconsistency of his highly philosophical views on the connection of science and religion being held in the same mind with ultra-covenantic views on other points, you must remember that he is a sincere enthusiast in the Free Kirk line. I have been re-reading with care your letters on educational matters. It is clear that you have reached what I can never live to see accomplished in England—a successful raising up of a body of secular or lay teachers as schoolmasters and mistresses, having on an average the same scale of pay, and a similar position in society to the clergy. The average pay of the latter in New England it would, I suppose, be more difficult to ascertain, as there are so many sects; and as they get presents, and have fees for marriages, burials, and christenings apart from their fixed salaries. If the most eminent lay teacher in England could hope to equal in salary the Archbishop of Canterbury, or if the latter could be levelled down to the standard, if something could be done to place secular and clerical teachers on the same social footing, we might get on and be emancipated from our trammels, and education proceed and move on with the spirit of the age, which it now lags behind. If it were equally gentlemanlike, men would take less and be lay teachers, so many of the best have scruples in undertaking the clerical office, such as it is with us. Making the Bible a school-book here, and setting poor children to read *Deuteronomy*, is a proof that our Church teaching is not meant to open their minds. People

will have education, so they manage thus by sham instruction to evade what they dread, *i.e.* the making them capable of thinking and reasoning. I believe the Bible is not a school-book with you. The success of the 'ragged schools' in Edinburgh has been lamentably checked by the Presbyterians and their clergy insisting on the Bible, and this making the Catholic priests object to the Romanist children attending, to whom it would have been of peculiar use. I am afraid that our clergy think they should lose influence if lay teachers were raised in schools. I imagine, on the contrary, that all the higher minds at least would gain. Here it is notorious that if you have three sons, and determine that they shall belong to the legal, medical, and clerical professions, you would select the least talented as the safest for the *Church*. I hope the progress of popular education may one day change this.

Ever most truly yours,
CHARLES LYELL.

To HIS FATHER.

Bowood: January 13, 1848.

My dear Father,—I presented your 'Dante's Lyrics,'[2] as you suggested, to Lord Lansdowne as from yourself this morning, and gave him also a nicely bound copy with the Italian on one side which is always much liked.

Lord L. remembered your essay, not only because he reads and remembers all that comes out, but because Mr. Davenport used to talk for ever to him of Rossetti's views, and Lord L. had thought that Rossetti had gone too far. Lord L. also asked me what you thought of Ugo Foscolo's performance, which he had read and commented on. He skimmed through your last edition, and said the analysis prefixed to the Sonnets was most useful and necessary. He thought there was so much in what is now going on in Italy like the old contests of Guelphs and Ghibellines, that it was calculated to keep alive the interest of Dante's writings. He begged me particularly to send his thanks for the books.

[2] *The Canzoniere of Dante Alighieri, and the Vita Nuova and Convito*, translated by Charles Lyell, Senior, of Kinnordy, N.B.

We found, what is always most pleasant, a small party, Lord Auckland and Macaulay having left to attend a Privy or Cabinet Council, the number at dinner being ten—our host and hostess, the Milmans, Mrs. Norton and her boy, a gentlemanlike young Etonian, Mr. Charles Austin, famed for having made more money in four years at the law than anyone ever did before, some say 40,000*l.* a year, by railways, and Mr. Charles Buller, M.P., who has now undertaken the poor law, and to be chief of the department. The conversation was very agreeable and without effort; Milman in good spirits though not strong, Buller and Austin both very original and literary. Fielding's novels were discussed *con amore*, Dickens and Thackeray rather run down too much, till young Norton said he was 'boiling;' Chaucer and Dryden; and then Mrs. Norton, who is really almost as handsome as ever, very ladylike and clever, had an argument with Milman, who maintained that translations of poems should be in verse and not 'stilted prose' as he called all prose translations.

Our party at Mr. Rogers' on Monday was brilliant, and no one engrossed too much. Mr. Empson, now editor of the 'Edinburgh Review,' and Mrs. Empson (Miss Jeffrey), Hallam, Babbage, Eastlake, and Mr. Luttrell; the latter, though oldish now, came in now and then with his witty sayings. Lord Campbell's 'Chancellors,' in which a letter of Lady Philip Francis, acknowledging her husband to be Junius, is given, brought up that old controversy, and Rogers confessed the truth of the tale, that when he was set on at Holland House to ask Sir Philip Francis if he might put a question to him, Sir Philip replied 'At your peril!' in so forbidding a tone, that Rogers retreated to the rest, and said 'If he is Junius, it is Junius *Brutus*.' On some one calling in question the great superiority of Junius, Rogers cited in support of it an able passage on the difference between injuries and insults; but Hallam said, 'After all, there is nothing in Junius so powerful as the comment of Dr. Johnson on it, when he said "that some people mistake the venom of the shaft for the vigour of the bow."' When Luttrell complained of cold, Hallam said, 'Don't let Rogers hear you, for his maxim is that no man can be cold except he be a fool or a beggar.'

The party are all going for a walk, so I must join them. Perhaps Mary will write to-morrow.

Believe me, my dear father, your affectionate son,

CHARLES LYELL.

To CHARLES BUNBURY, ESQ. (*who was travelling in Italy*).

Bowood: January 14, 1848.

My dear Bunbury,—Your letter was most agreeable to me,[3] especially as knowing something of that region of calcareous rocks in the south, and remembering the general aspect of the vegetation without having made out why it looked as it does, which your description of the part played by the different species of trees, shrubs, and plants, many of which I well remember, so well explains. I believe most of the limestone which we used to consider as part of the cretaceous series, with its nummulites, is now voted by many to be intermediate between Cretaceous and Eocene, but I should like to know more about that. I am very sorry that Susan's drawing-book was lost, as I am sure it contained many valuable memoranda.[4] I am much pleased with her picture of Mary, and think the last touches improved it much. Eastlake says it is very well painted, much beyond any former work of hers, and as to likeness he added, 'Unhappy as I have often thought the lot of the portrait painter, yet I do not believe that their plight is quite so miserable as that people should not be satisfied with such an excellent resemblance to the original as this.' My father has read your 'Botany of Southern France' with much delight. The chief geological news is the arrival of eight hundred specimens of bones of fossil birds, in the most perfect state of preservation, from clefts and caves of New Zealand, buried in loose volcanic sand. They belong to ten or more species of Moa, or Dinornis, one ten to twelve feet high. The skulls and eggs are found. The largest would have made a

[3] Treating of the botany of the South of France.

[4] His sister-in-law, Miss Horner, who had been in Rome with Mr. and Mrs. Bunbury, and who suffered shipwreck in the 'Ariel,' off the Vado rocks, near Leghorn, and lost her drawings among other things.

more gigantic footprint than the biggest of Hitchcock's Connecticut marks. Eastlake, whom I sat next to at Rogers' dinner, was, I find, much taken with Owen's article on 'Paleontology' (on Broderip) in the last 'Quarterly Review.' Sir John Herschel's, on 'Humboldt's Cosmos,' in the last 'Edinburgh,' is also much thought of.

Ever affectionately yours,

CHARLES LYELL.

To HIS SISTER.

11 Harley Street: February 7, 1848.

My dearest Eleanor,—When we read your letter this morning, and saw how much you and the rest, including my dear mother, had been thinking of *our lecture*,[5] in spite of so many of you being invalids, we were quite sorry that we did not some of us send a note on Saturday to say that it came off much to my satisfaction. The consciousness that no one else either in Europe or the United States could from actual observation have given the same account of the nature of the evidence, and what was genuine and what spurious, respecting the proofs of the first quadruped or air-breathing reptile ever found in such ancient rocks as the coal-strata, gave me confidence and spirit, as I knew it would be of interest to all the geologists present. It was, as Dr. Fitton remarked to Mary before I began, a glorious audience, and the full benches made me perform with much more ease to myself. Before lecture, Faraday pleased me by some hints, and showing me his private memoranda for lectures, and telling me what I suspect he hardly ever did to anyone, part of his mechanism for timing the different parts. It is wonderful how much I had come by practice to the same results. He has given fifty or a hundred lectures to my one, and is the chief master of the art in England, to my mind. The number present, as noted down at the entrance, was 398, but it may have been more, as Mr. Barlow does not quite trust the new porter.

With love to all, ever your affectionate brother,

CHARLES LYELL.

[5] Lecture at the Royal Institution, on a Reptile in the Coal-formation of the Alleghanies.

To His Sister.

Sunday, February 27, 1848.

Dearest Marianne,—I must give you a few words on my party yesterday, as, if I lose any time, there is so much going on in these eventful times that I shall forget what passed. When I got to Sir R. Peel's, Bunsen was the only one arrived, so after making my bow to Lady Peel and her daughter, and shaking hands with my host, I heard the Prussian Ambassador give us a full account of a member of his embassy who had left Paris on the Thursday of the Revolution passing over barricades and having some hair-breadth escapes. Bunsen told us that there are some 30,000 communists in Paris who are for property in common and no marriage, and who are much to be feared by those who have aught to lose. He (Bunsen) blamed Louis Philippe for not having seen some months ago that a moderate extension of the suffrage could alone defer some catastrophe. The party which next came in were Faraday, Sir Stratford Canning, Buckland, Lord St. Germans, Owen, De la Bêche, Sir Benjamin Brodie, Mr. Hamilton, Hallam, Sir James Graham, Dr. Mantell; making with me and a young son of Sir Robert's seventeen; the eighteenth or missing one was Lord Aberdeen, whose excuse came in after I got there. I sat between Buckland and Faraday, F. being next Peel, on whose other side was Hamilton, and next him Owen, and we had much pleasant talk, both *tête-à-tête* and we six all together. After the ladies retired, I expected little more than a continuance of conversation with next neighbours; but Sir Robert remaining in the same place, asked Bunsen to tell them his latest Paris news, which he did from near the top of the table, all questioning him. Then Sir Robert gave an account of what the French Ambassador had told him just two hours before, and I do not think I ever before remember fifteen persons exchanging so many ideas, chiefly because most of them were in different ways public men, and not afraid to hear the sound of their own voices, and partly from so many being well acquainted with nearly all the others. Sir S. Canning was asked what he thought would be the effect on

Switzerland, from which he had just returned. Hallam talked a good deal with Bunsen, Graham, Peel, and Canning on the merits and demerits of Lamartine's new book on the French Revolutionary period, the effect of which some of them regard as very mischievous, especially now. If Louis Philippe, even at the last hour, had on giving up Guizot chosen Thiers or some other eminent reformer, Barrot for example (neither of whom are republicans), instead of a conservative like Molé, his throne might perhaps have been saved, and if not to him, at least to his dynasty. I was struck with the little feeling the whole party had for him, though they were of course hoping he would escape. Hallam, who was intimate with Guizot when he was in London, and since at Paris, told me as he took me home in his carriage, how anxious he was about him and his safety. He said he could not defend his late career, but he liked him much.

Sir Robert told us very clearly, at Brodie's request, two stories of his having respited two different criminals, condemned by the Judges on circumstantial evidence, both of whom, when Secretary for the Home Department, he proved to be guiltless.

Believe me your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

March 16, 1848.

At the Romillys' party yesterday, we had a specimen of the monetary panic of Paris transferred to London; not a few in the room, especially those connected with Geneva, having considerable investments in the French funds, canal shares, railroads, and having their political misgivings greatly heightened by their sensitiveness about the loss of their incomes. Mr. Strutt, M.P., Mr. Wickham, of the Stamp Office, and their wives, Mr. Marcet, Dr. Roget, Mr. and Mrs. Kay Shuttleworth, Mr. Parker, of the Treasury. Shuttleworth told us that Mr. Jones Loyd, the great banker, had just informed him that his foreign broker had failed to negotiate a good bill on Vienna, and told him that at that moment

there were only two important cities in all Europe, Hamburgh and Amsterdam, on which he was able to negotiate bills. So general a commercial disturbance was never known. Lord Normanby had just sent for 500 sovereigns to get on with, until specie was forthcoming in Paris. The general opinion seemed to be, that long before the 900 meet, or even before the elections begin, there will be a collision of parties. The day I dined with Sir R. Peel, when the Republic was just proclaimed, Sir Robert said there will be a financial crisis. But many here think that might have been avoided but for the measures of the Provisional Government, which frightened capitalists by increasing the burdens by 25,000 additional troops; increased rations for sailors in the navy; a promise to find work and wages for any one of the 35,000,000 that might want it; one pound a day for every one of the 900 until they had made a constitution; paying one per cent. more for all money in the savings bank; and no retrenchment except of the civil employés. Against which we have to set the giving up the tax on the newspaper stamps, and a promise to give up the *octroi* of Paris. Mr. Empson, now editor of the 'Edinburgh Review,' remarked to me that either the whole world, writers on political economy, statesmen and all, have been in their dotage up to this hour, and Louis Blanc has made the grandest discovery of the age, or they are the most arrant fools for promising to find work and wages, to give labourers the profit of capital. There are not a few who hope that after some extraordinary changes the country will right itself, for they have a plentiful harvest in prospect and vast resources, but it is an awful experiment and risk.

Ever affectionately yours,

CHARLES LYELL.

To HIS SISTER.

London: April 2, 1848.

We went yesterday to see the studio of Lough the sculptor, who is a man, I think, of considerable genius, and has some spacious rooms filled with models, many of them colossal, such as 'Milton's Satan,' and some which he made for the House of Lords, but did not succeed in his competi-

tion. I think his model for the Nelson column, which was nearly chosen, for he missed it only by two votes, would have been very superior to that which gained the prize. A large statue of Nelson, without the cocked hat which now disfigures it, not placed out of sight in the clouds, with four statues of sailors at the four corners of the pedestal, and on the sides of this alto-relievos of sea-fights, &c. Among the company viewing the sculpture was Madame Bunsen, who told me that her husband had just received the official news of the fight in the streets of Berlin, and that instead of the newspaper story of 2,000 soldiers killed, there were only 140, and only four officers instead of forty, and they presume of the people in the same proportion. She flatters herself that the Government is now firmly established in Prussia. We had a pleasant party at Sir Edward Ryan's;[6] he in good spirits, and a young friend of his, about thirty, Mr. Gibbs, a lawyer, fellow of Trinity College, Cambridge, well informed and lively; Dr. Fitton in great force. I got him to refresh my memory with his story of a Dublin professor who said to his class, 'Gentlemen, the Hon. Mr. Boyle was a great man; he was the father of chemistry, and uncle to the Earl of Cork;' from which, says Fitton, his pupils worked out the conclusion that chemistry and the Earl of Cork were first cousins. At the Zoological Gardens to-day, we saw Broadhead, the Secretary of Legation, who told me there is no doubt that the Duke and Duchess of Montpensier went off in a huff. They called suddenly and unexpectedly on the Queen, not *incog.* but in their public capacity, when she was in a delicate state of health, and not knowing exactly what to do, and fearing she might commit herself, she very naturally sent off to Lord Palmerston to come directly, but before he got there, they had waited and waited till they got out of humour, and set off in about thirty hours afterwards, on their way to Rotterdam, whence they are said to have taken ship to St.

[6] Late Chief Justice in Calcutta, from whence he returned in 1843. He was made a member of the Privy Council and Civil Service Commissioner, and for his sound judgment and sense, his advice was sought by statesmen and others, and his genial nature was a delight to all who had the privilege of knowing him.

Sebastian, and if Spain be in the state reported, they will soon wish themselves back in London. The other day I had a short talk with the Bishop of Oxford, who said that Guizot had the merit not only of writing history, but of making it. The first day that news came of the French having proclaimed their Republic, and among other things the Provisional Government having ordered troops to the frontiers, I met the Bishop of Llandaff at the Athenæum, and he asked me what I thought of the affair. I said it reminded me of the old cycle of political events, which the ancients were so fond of believing, upon which he repeated the lines: 'erunt etiam altera bella; Atque iterum ad Trojam magnus mittetur Achilles;' and he added, 'I wonder who will be their great Achilles this time.' I told him probably some 'petit caporal' of whom none of us have yet heard. The Swiss consul, John Prevost, remarked to me to-day, that one result is clear; most of the French capitalists and bankers are ruined.

On Sir Edward Ryan's table were several handsome pieces of plate, after classical models, worked by native Hindoos, and with inscriptions intimating that they were given from gratitude to him (Sir Edward) for his exertions to schools and colleges for the education of the natives. Sir Edward told us when we were talking of modern orators, that he heard Lord Lansdowne speak for an hour on the sending an ambassador to Rome, and although it read well in the papers, it was far better in the delivery, as he was very animated and his action and manner so good. A petition is getting up for a royal commission to go to Oxford and Cambridge, and the signatures of fellows of colleges, and even of the clergy, are already most numerous. I have obtained a good many, and a pamphlet is just come out, quite in the spirit of my chapter on the 'Universities,' by the Rev. Mr. Jowett and Mr. Arthur Stanley, son of the Bishop of Norwich, which is excellent. A considerable reform at Cambridge is much agitated, but a little pressure from without is desirable, to aid the reformers within. A strong wish to revive the utility of Professor Smyth's Historical Professorship at Cambridge, is showing itself in the University.

Ever affectionately,

CHARLES LYELL.

To His Sister.

April, 1848.

When I got to the council-room,[7] I found Sir Robert Inglis and his party mustering pretty strong. After De la Bêche had spoken in favour of scientific Presidents and a short term of office (two years), I seconded his motion, and as an argument against going on with aristocratic Presidents, as we have been doing so long, I pointed out that of forty-eight members of the Upper House who now sign F.R.S. to their names, and who may be taken as that part of our higher aristocracy who care most for science, not one ever wrote a single paper in the 'Philosophical Transactions' except Brougham, thirty-three years before he was made a peer. I then mentioned four or five exceptions, of men who like Lord Northampton, then in the chair, had a real feeling for science. I said I admired our peers as a body for their talent, but that made their neglect of science the more marked. It was owing to our University system, which also governed the great schools; even Cambridge, while she put a powerful instrument into the hands of a student, gave him no taste for its application, and, like Oxford, shunned the progressive sciences. I have no wish to disparage our aristocracy as a political body, nor wish them to have less social rank, but why do homage to a body that care for and know so little about science? Inglis and Hopkins spoke at full length on the other side, and it ended in our agreeing not to divide. We gave up insisting on two years' limitation, while they agreed not to insist on permanency; that science should have its turn at least, which as we have a majority they could not help; and finally that Colonel Sabine and Mr. Lyell be appointed a deputation to go down to Sir John Herschel's, in Kent, to try and persuade him to be President. Whether we succeed or not, it is a point gained that it should be offered to science, and if he declines, we will try some other. Faraday's health makes him out of the question. A great many of us are for Robert Brown.

Charles Lyell.

[7] Of the Royal Society.

To Charles Bunbury, Esq.

May, 1848.

My dear Bunbury,—If I have not written to you for some time, it is because the affairs of the Royal Society, still in a state of transition, have occupied my leisure moments. Trying in vain to get Herschel and Faraday to be Presidents, then to stir up Robert Brown's courage to let us assert a principle in nominating him, then ending with getting Lord Rosse to say he would stand, then choosing the fifteen out of all the candidates for the year, then a new secretary (Grove, I hope), and various reforms against a set of obstructives, compared to whom Metternich was, I presume, a progressive animal. When Sismonda, who has made a beautiful map of Sardinia, came here, I immediately asked him if he would lay before you all the evidence from fossil plants of the supposed occurrence of carboniferous species in the lias. He told me he wished much to do so, that it was high time that Adolphe Brongniart's first dicta thereupon should be reconsidered, and that he had the only complete collection, and all of them should be submitted to you. He thinks the problem, as I do, the most puzzling and curious of all the theoretical points yet undecided in Geology, and worth a journey to Italy by any competent botanist like you, whose papers he knows, as he takes in our Journal. He is not quite satisfied that Brongniart has gone critically into the affair, though I suspect you found that he had, yet Sismonda has got together great materials since that.

You will be glad to hear that Owen, after seeing Goldfuss's published account, entirely confirms all that Falconer told us of the true reptilian character of those fossils in the coal of Saarbrück, for the age of which V. Decken vouches.

So now, besides my Pennsylvanian footsteps we have about three species recognised by their bones, skull vertebræ and all, of an order which according to the theory of progressive development came in only with the Permian. But they will merely shift their starting point, and never take warning. Owen told me yesterday, that Bunyeep now turns out to be a

foal and not a calf, and I believe I shall have to make out the sea-serpent to be a shark.

Ever your affectionate brother-in-law,

CHARLES LYELL.

To CHARLES BUNBURY, ESQ.

Kinnordy: August 2, 1848.

My dear Bunbury,—We have been following you with much interest in your journey through Tuscany and the land of musquitoes and robbers, and I was very glad to receive here your letter to me, in which, among other matters, you mention an entomological confirmation of a story I have often told, till the wonder it excited began to make me doubt it myself. I took a large dragon-fly (if I am not mistaken, *Œshna juncœa*), and having carefully eviscerated it, put a straw, *secundum artem*, inside the abdomen to keep it distended. Before I impaled it, the creature, which had been stunned by a blow (in the thorax, I presume), recovered, and flew out of the window. I ran out and watched it to the roof of the house, when the wind taking it, it sailed off in grand style, the straw seeming just to balance the lost weight of viscera. But I admire your cicada much more for doing without a make-weight. You inquire about Joseph Hooker. The last piece of news is enough to make your mouth water. He had found *three* new species of Magnolia in the Himalaya mountains in one day. His father has printed a letter in the 'Botanical Magazine,' with amusing gossip about the journey through Egypt with Lord Dalhousie, Aden, and Madras, where they were received (the Governor-General and suite) in state, and a few passing notes on the plants and fossil forest in the desert.

I have walked with Mary to the site (still the only one) of the *Linnæa borealis*, which now measures 13 feet 3 inches in a north and south direction, and 19 feet east and west. By-and-by I shall compare it with its size in former years, and we will see if we can calculate back to the day when some grouse or emberiza, driven down by cold from the Grampians, and burrowing for blackberries in the snow, rubbed off one of the minute seeds from their feathers in the

spot where you were destined to see it so soon after you had dismounted from your steed in 1844. It was in full flower in the end of June, when Katharine[8] paid it a visit, and picked some of it. At Sir Philip Egerton's we saw a large sheet of water entirely covered with the leaves and yellow flowers of *Menyanthes nymphæfolia*. I am glad you saw Targioni, and hope you will have found Sismonda at home. I am glad you saw the Brazilian ferns of Raddi, as I have no doubt you gained new ideas. My father received your letter from Florence, which we all read with much pleasure. The foraminifera of the Sienna marls are innumerable as I am well aware, and I have seen recent marl from the Mediterranean off the delta of the Nile, equally full of recent species.

August 3.—I have just been reading an extract in the last 'Edinburgh Review' (art. on 'Sharpe's Egypt') from Miss Martineau's 'Egypt,' certainly one of the most eloquent in the English language. If Harriet should be excommunicated for certain doctrines boldly put forth in this the most able work she has produced, it is certainly better worth being a martyr for than her mesmerism. Joseph Hooker was shown in Malta some of the huge Miocene fossil shark's teeth as having been those of St. Paul. If the Apostles had a succession of teeth through life, like the Squalidæ, without a proportional quantity of toothache, from which I have been suffering for the last week, I envy them their gifts. I shall be glad if you return by the Simplon, as, having seen it twice, I should like to see it often again, whereas I am quite satisfied with the Mont Cenis, although the Italian ascent of that pass is very interesting. As we shall be talking of new 'Quarterlies' and 'Edinburghs' when you return, I may as well mention that Milman wrote the article on 'Pope Ganganelli' in the last 'Quarterly Review,' with which my father is much delighted, and Guizot that on the 'State of Religion in France,' translated by Mrs. Austin, with which I have been much interested. Carlyle is said to have written the entertaining article on 'Goldsmith' in the 'Edinburgh,' and I know that Francis Newman wrote that on 'Tests,' and Peacock that on 'Herschel.'

[8] His sister-in-law, Mrs. H. Lyell.

With my love to Frances, believe me, my dear Bunbury, ever your affectionate brother-in-law,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Kinnordy : September 11, 1848.

My dear Horner,—As there is nothing in this morning's (Friday's) Gazette, there may be in that of Tuesday. The delay has I presume been caused by Lord Lansdowne's having left town for Bowood. I send you an extract from Lord Lansdowne's letter, that you may understand how the matter stands: 'I have thought it on consideration so fit in the distinguished situation you occupy, and with your scientific reputation, that you should receive the distinction of knighthood, that I took it upon myself to mention the subject to the Queen, and I have her Majesty's authority to state that she will most willingly confer it upon you, and she understands that it is without any solicitation on your part. Had you been near London, I should have proposed to you to attend the Council on Monday for that purpose, but it can be gazetted without your attendance.'

Ever yours affectionately,

CHARLES LYELL.

To GIDEON MANTELL, ESQ.

Kinnordy, Kirriemuir, N.B.: September 24, 1848.

My dear Mantell,—Although at the southern extremity of the island, you are the first person, excepting a member of my own family, who has addressed a letter to me under my new denomination, and I thank you sincerely for your congratulations. The manner in which the honour was conferred, both on the part of the Ministers and the Queen, has been such as every scientific friend would approve of, and I had a most agreeable geological exploring on the banks of the Dee, into which Prince Albert entered with much spirit. I am sure your lectures in the Isle of Wight will have sown some good seed, for the Milmans, to whom I lent your book, have been profiting by it in their examinations of Purbeck, and speak of it most approvingly. I am glad to hear of the

new discoveries, and that the two papers for the Royal Society are getting ready. By staying in town, I and a few others flatter ourselves we have put at the end of the session the printing and referring of papers on a better footing for the future, though we have still much to do. The Royal Society council work is no sinecure to those who have a reforming spirit. I have hitherto missed no meeting since I was elected.

Believe me, with my wife's kind remembrances, ever, my dear Mantell, yours most truly,

CHARLES LYELL.

To HIS SISTER.

London, 1848.

My dear Marianne,—Mary has given you the journal of our late proceedings, but has not had room for any particulars, and I have not time, as I should like to have, were it only to refresh my memory, to tell you of some of the people we have met and the things they said.

Few dinners have pleased me more than that at Dr. Whately's. Fortunately two M.P.'s, I know not who they were, did not come, but sent their excuses just before we sat down, it being the second night of the debate on Church Rates and of the division. This reduced the party to six, a number who could all talk together, and could not talk *party* politics, an excellent representation of France and of America, and the Archbishop, a strange compound of an Oxford Churchman grafted on Ireland, and full of information about all that is going on there, which he views with interest more as a political economist than in any other light, as far as I could judge.

Mr. Dewer is a lawyer of considerable practice in New York, now deputed to arrange some banking concerns between the United States and England. He wrote the first good digest of American law. His good temper, I would almost say magnanimity, in talking to De Beaumont on the tender question of slavery in America, considering what a satire 'Marie' contains, struck me much. We talked of Miss Martineau's book, parts of which must be very

clever. The Archbishop said, that if women ever became invested with political rights here, it might be well to have two Houses, and let the women *speak* in one and the men vote in the other, for since the Irish members have got in, he saw no other way of economising time. Dr. Whately is a great philologist. When on such subjects he said, 'De Beaumont, you have no word for "home."' De Beaumont said, 'No, perhaps because we have less of the *thing* than you have. We have said of late, "mon chez moi," "son chez soi," but that is very clumsy; and then you have another word, "job," which we cannot translate; it is a sublime word that—God knows we have the *thing*.' The Archbishop was philosophising on the cause of their not having the word 'job,' and said that their representative form of government was so new, and in a pure monarchy there were fewer true jobs. De Beaumont said, 'Certainly there are no jobs under an absolute despotism; because it is all *one great job*, and there is no room for small ones.' De Beaumont gave us an amusing account of his wonder at the aristocratic manners of society in England as contrasted with France, and its effects on social intercourse, in which he saw clearly enough what was absurd and ridiculous. Dr. Whately explained to him why Englishmen, being in fact socially disposed, were obliged to be stiff to strangers, because all were trying to hang upon and be pulled up by the skirts of those above them. When De Beaumont asked how many grades there were in society, the Archbishop said, 'I cannot say how low it goes, but the other day some chimney-sweepers presented a petition to the Lord Mayor against others who had intruded themselves into their privilege of dancing, &c., on May day, and in this petition they said "that certain dustmen and other *low fellows, pretending to be chimney-sweepers*," &c., so the degrees of rank probably descend even below the dustmen.' A very interesting discussion arose about the effects of the French, American, and English laws of the division of property as contrasted with each other. De Beaumont defended the system of division so far as agriculture was concerned, which Dr. Whately was most afraid of. I then asked De Beaumont whether he did not feel already that the small fortunes in France enabled a wealthy Government

to bribe the majority, not only of the electors, but even of those elected. He said, 'Yes; but then we must greatly increase the number of electors, and we may do that safely when millions become landed proprietors, no matter how small their estates.' I objected that still the Government could offer irresistible bribes to the majority of the deputies, which was impossible when there were so many large fortunes as in England. When I had thus driven him home, he began a sort of confession, having previously seemed determined to be an optimist on French affairs. He said, 'I grant you that it is equality rather than liberty that we are tending to; the wide distribution of property is raising the *morale* of the great mass of our population above yours, and it is producing a centralisation force in the Government; but this must end, I fear, in the central power being so great there is an end to that liberty which I believe nothing but an aristocracy can preserve.' The Archbishop brought out a pamphlet to prove that in one district near Paris the average property of eleven thousand landed proprietors was the quarter of an English acre each, and he began imagining, when the division had gone farther, a question of law arising as to whether a huntsman had committed a trespass by clearing his neighbour's estate at one leap. Dewer denied that the equal division in America was producing small properties, which he supposed must arise from the rapidity with which large fortunes were daily made, and the new lands obtained in the new settlements.

At our party at Mr. Whitmore's yesterday, the Archbishop told us one of the late Lord Norbury's puns. The two curates of St. George's Chapel, Dublin, were then, and are now, Mr. Short and Mr. Bridge—and very long-winded preachers. Lord N., on being asked how he liked them, said 'he could wish that Bridge was shortened, and Short abridged.'

With love to all, your affectionate brother,

CHARLES LYELL.

CHAPTER XXVI.

JANUARY 1849–JULY 1851.

DR. HOOKER IN INDIA—MACAULAY'S 'HISTORY OF ENGLAND'—TOUR ON DEESIDE—VISIT TO SIR JAMES CLARK—BALMORAL—TICKNOR'S 'HISTORY OF SPANISH LITERATURE'—VISIT TO GERMANY—BOTANY OF THE HARTZ—GEOLOGY OF SAXONY—LETTERS OF IGNATIUS—PREJUDICE AGAINST SCIENCE—TRACTARIANISM—LECTURE AT IPSWICH—EXHIBITION IN HYDE PARK—RAFFAEL'S CARTOONS.

[He was re-elected President of the Geological Society in February 1849, and during his term of office communicated two important papers, 'On Craters of Denudation, with Observations on the Structure and Growth of Volcanic Cones,' and 'On Fossil Rain-Marks of the recent Triassic and Carboniferous Periods.' He published his 'Second Visit to the United States of North America' this year, and he presided over the Geological Section at the British Association at Birmingham.

In 1850 he became one of the Royal Commissioners for the first Great Exhibition, which was opened in Hyde Park on May 1, 1851. Sir Charles Lyell gave several lectures at the Royal Institution and elsewhere during these years.]

CORRESPONDENCE.

To His Father.

11 Harley Street: January 11, 1849.

My dear Father,—Mary has, I believe, told you that I was clever enough to scald my foot, and was getting well, but walked so many miles yesterday that I am now a prisoner for a day. I put a finishing stroke by walking to St. James' Street to attend a meeting of the Graphic Society, to which a committee of artists had invited me. There I found Ruskin, Eastlake, Boxall, and other artists and amateurs, Hallam, Babbage, Sir R. Inglis, Bishop of Oxford, and saw some very beautiful drawings by Turner, and by one

Knowles, of the Parthenon, and heard good talk about Phidias, and how he would be astonished to see the black stains caused by smoking chimneys of cottages, and red stains of iron on the columns, instead of his azure and gold; and how, if Lord Elgin had not bribed the Pasha, the French Consul would, and had both left the sculpture, time would have destroyed more than half ere this. I am getting on steadily with my work, and we have finished vol. i. of Macaulay, though frequently referring back to it, to read again favourite passages. Longman is stereotyping it, encouraged by the rapid sale. There is a higher moral tone in it, and less party feeling, than in any of his reviews, and it is the result of an amount of reading and of remembering what he has read, which is wonderful to think of.

Sir William Hooker has been corresponding with Charles Bunbury, and tells him that Joseph Hooker was going under escort of a guard from the Rajah of Nepaul to ascend the highest mountain, more than 28,000 feet high, and that he tells him that since he left the plains of India, no less than *four* of his (J. H.'s) intimate friends have died, and among them Mr. Williams the geologist. This intelligence comes home to me, for when I drew up, after several communications with Lord Auckland, my address to the East India Board on sending out a geologist to India, I pointed out that every one of five geologists whom they had sent out had been cut off in the prime of life, for want of aid in assistants, elephants, steamers, &c., which could alone enable them safely and effectively to perform their mission; and I protested, with De la Bêche, against the best of his practical men (the said Williams) being sent out on a forlorn hope. He has done his business, poor fellow, well, put them in the way of working rich mines of coal, and is now left like his predecessors to die in a ditch. Heaven grant that poor Joseph Hooker may be spared, but I dread Assam and Borneo, and would rather have the work on the Antarctic regions and still unpublished notes than all the magnolias in the Himalaya. His last paper on fossil botany is much thought of. With love to all at Kinnordy,

Believe me, my dear father, your ever affectionate son,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

February 7, 1849.

My dear Ticknor,—Agassiz' lectures on 'Embryology' interested us much, and the sale of them astonishes our naturalists. We have read Macaulay with much delight. It is a great proof of his genius that he makes one feel as if present at the scenes he describes, and as if one had lived in those times, almost as much as in reading Pepys' 'Diary.' There is a want of generosity I think in regard to Penn and some others, not that one wishes to have their delinquencies concealed, but the characters of such men, and of Marlborough, ought to be allowed to unfold themselves, and they ought not to be drawn before the events are related for which they are so unsparingly condemned. I had an argument with Macaulay about the atrocious crimes which he says God commanded the Israelites to perpetrate. All he could say was that he was on 'the orthodox' side, and that according to my view 'the God of the Old Testament differed from the God of the New,' and that if I merely thought that the Israelites *believed* they were acting under God's special command when they hewed Agag in pieces, and that they were mistaken, I should be obliged to renounce their history and the prophets.

That he himself believed it he neither said nor the contrary, but certainly he need not have written that passage about the Puritans in such strong terms. As Francis Newman, the brother of the great Tractarian who has gone over to Rome, takes the lead here of our rationalists, so the brother of the Puseyite saint, Mr. Froude of Oriel, who died and left some curious memoirs, has come out with a book called the 'Nemesis of Faith,' not very short of Theodore Parker's opinions, and written not without ability. As he is a lay fellow of Exeter College, Oxford, it remains to be seen whether they will or can expel him.

I have been very busy with my inauguration dinner as President of the Geological Society, and succeeded in getting the Archbishop of Canterbury (Dr. Sumner, author of 'Records of Creation,' a geologico-theological work), Sir

Robert Peel, Van de Weyer, and a great many M.P.'s and notabilities to come, so that the speaking is allowed to be the most brilliant we ever had at any anniversary. Sedgwick spoke very eloquently, and Peel; and the Archbishop made a straightforward and manly speech. I have been returning the Archbishop's call to-day, and was much struck with the magnificent appearance which the new houses of the Legislature, or the 'Palace of Westminster,' make from the Lambeth bank of the river. When will you come and see the new creation, in the old florid gothic style, grouping beautifully with the towers of Westminster Abbey? Ever most truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Kinnordy: July 29, 1849.

My dear Horner,—I return you Empson's letter with many thanks. His commendations and Lord Jeffrey's are a reward for taking pains with the book, and if, like an *achromatic* telescope, it has presented objects as they are, without imparting to them any colouring of its own, I may feel gratified by that compliment. I fear, however, that the strong anti-slavery movement in New England, from a natural desire at this moment to stop the spread and accession of new Slave territory, is causing them so to misrepresent the real state of the South, and the negroes, that they will write against that part of my work. I have just finished reading this morning your first anniversary address, which is excellent. Your criticism of Agassiz where he disputes all identification of recent and fossil species is well put. You ought to have seen him at Southampton on our dredging expedition. E. Forbes showed him some of the varieties of common shells, which occur also fossil in the red crag, and which Agassiz had declared were not varieties, but extinct species. When he was convinced that the same varieties flourished now, he said 'if Lyell would give up half his percentage doctrines, he would give up half his objections,' or something to that effect.

Believe me ever affectionately yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Birkhall: September 3, 1849.

My dear Horner,—I have been spending my time in a very enjoyable and by no means uninstructive way here, and have felt all my visiting at Balmoral, in the whole course of which there has not been a single drawback, not only pleasant, but I hope useful, as helping forward that taste for natural history and science which is intended to form a part of the education of the young people, and expected to prove a resource to them. What Van de Weyer said of the steady development of Prince Albert's mind, in a great variety of directions, I had been able more to appreciate. His German reading on serious subjects makes him an improving companion to one who is not versed in what is going on in that world, and I had much good talk with him alone, on a variety of grave subjects, as well as on the different *insects* which belong to Switzerland, the Isle of Wight, and Scotland respectively. That he knew so much about these was quite a new light to me. I had two long walks with Mr. Birch and his pupil. Lord John Russell made himself very agreeable to me, and I like the rest of the household. There reigns a strong wish to live here in privacy, which is most wholesome to the mind, after such a life of representation. The Prince has just finished Macaulay, and his discussion of it with me was one of many fruitful subjects for comparing notes and opinions.

With love to all at Rivermede, ever affectionately yours,

CHARLES LYELL.

To HIS SISTER-IN-LAW, MISS HORNER.

Kinnordy: September 5, 1849.

My dearest Susan,—I told your father that I would send you a little gossip of our late tour on Deeside, during which I had some good geological work on some remarkable hills composed entirely of serpentine in Glen Muick, and some botanising, with much useful and healthy exercise, in addition to agreeable companionship with the Clarks, *père*, *mère*, and *fils*, and parts of three days which I spent at Balmoral.

The day I went to dine there, Saturday last, I had first a long walk—Sir James Clark and I—with Mr. Birch [9] and his pupil, a pleasing, lively boy, whose animated description of the conjuror, or Wizard of the North, whom they had seen a few days before, was very amusing. 'He (the wizard) had cut to pieces mamma's pocket-handkerchief, then darned it and ironed it, so that it was as entire as ever; he had fired a pistol, and caused five or six watches to go through Gibb's (one of their footmen) head, and all were tied to a chair on Gibb's other side,' and so forth; 'but papa (Prince Albert) knows how all these things are done, and had the watches really gone through Gibb's head he could hardly have looked so well, though he was confounded.' Sometimes I walked alone with the child, who asked me the names of plants, and to let him see spiders, &c., through my magnifying glass, sometimes with the tutor, whom I continue to like more as I become better acquainted. After our ramble of two hours and a half through some wild scenery, I was sent for to join another party, when I found the Queen, Prince, and Lord John, by a deep pool on the river Dee, fishing for trout and salmon.

On the way home we visited the quarry with the trap dike cutting through limestone, and producing garnets, which I found out last year, and I talked a little about it. After the Queen had entered the Castle, the Prince kept me so long, and we kept one another so late, talking on all kinds of subjects, that a messenger came from her Majesty saying it was only a quarter of an hour to dinner-time.

After the ladies had gone to the drawing-room, we had much lively talk, which the Prince promoted greatly, telling some amusing stories himself, and encouraging others by laughing at theirs. Lord John Russell, and Lord Portman and myself, had nearly the whole talk to ourselves, but anyone who chose could cut in. Sir J. Clark was not well, and could not dine with us. I played whist in the evening with Colonel Gordon, Mr. Anson, and Mr. Farquharson of Invercauld.

Next day I went to church, and we heard a good practical sermon on good works by Mr. Anderson, who has none of that shyness attributed to him by the 'Times' correspond-

[9] Tutor to the Prince of Wales, who was then not eight years old.

ence. The prayer for the parish, magistracy, Queen and royal family, judges, ministers of religion, parliament, and whole nation, was just such as you would have liked, and in excellent taste, with nothing which a republican jealous of equality could, I think, have objected to, and which I believe our sovereign and her husband would thoroughly appreciate the simplicity of. They shoved the box on the end of a long pole to Queen and Prince and maids of honour, as to all the rest of the congregation, and each dropped in their piece of coin. After church I had much conversation alone with Prince Albert, whose mind is in full activity on a variety of grave subjects while he is invigorating his body with field sports. Charles Bunbury has just summoned me to take a geological walk with him. Caroline has just come in, in great glee, to announce the discovery, for the first time, of *Orthotrichum Lyellii*[1] in fruit, which Charles Bunbury admits is a grand find.

Believe me, with love to all,

Ever your affectionate brother,

CHARLES LYELL.

To CHARLES BUNBURY, ESQ.

11 Harley Street, London: January 17, 1850.

My dear Bunbury,—I have been so busy with my anniversary speech that I have had no time to thank you for your letter. There was a good discussion, and Darwin adopts my views as to Mauritius, St. Jago, and so-called elevation craters, which he has examined, and was puzzled with.

I am much pleased to hear that you have paid my 'Second Visit' a compliment which I fear I rarely pay any modern book, that of re-reading it. I believe if you visited the United States, and stayed long enough, above all, if you re-visited it after a lapse of five years, you would feel exhilarated, as I did, at the rapid rate of general progress in wealth, order, intelligence, education, and rational (or at least more rational) ideas of government in so brief a period. I am told by my correspondents that I should now find things greatly improved

[1] A moss named after Mr. Lyell, senior.

since 1846, even in literature. For example, my friend Ticknor has come out with three large thick octavo volumes on the 'History of the Literature of Spain,' the work of his life, of which Hallam, Milman, Ford, and Lord Mahon speak in very high terms, and which I have read scraps of with much pleasure. Murray says that such a book could scarcely here do more than pay its expenses, 750 copies being as much as he dares reprint. Now three different booksellers offered Ticknor for the use, for one year, of his stereotype plates, 5,000 dollars, and Harper, of New York, at last gave 5,250, or above 1,000 guineas. This, Ticknor says, could not have been done in 1846.

As to California, so many New Englanders are gone there, who, with emigrants from New York, &c., all understand each other, that they govern and legislate for all the rest, and have improvised a constitution far superior to any of the new ones planned and overthrown, or now on trial in the last two years in Europe. The determination not to have slavery bespeaks a wholesome prevalence of Northern men. In France I fear the new law of schools will place them far too much under the Catholic priesthood, and the same cause will prevent the Italians from becoming fit for representative government, and they will be voted incapable because those above them are determined they shall remain children. But periodical revolutions such as we have witnessed of late are the lamentable alternative of not acting honestly towards the millions, and having no faith in human progress.

I am glad you have planned your new book. Adolphe Brongniart's article on the genera of fossil plants [2] is a masterly production so far as I can judge. It is only by this double view, first botanical, then geological and chronological, that the subject can be thoroughly exhausted. There is some hope even for the *Old* World, when such essays can appear under an experimental republic with universal suffrage.

Agassiz, I am told, is about to marry a young lady of good Boston connections. If so, he will be a New Englander for the rest of his life, and will be the founder of a school of

[2] *Tableau des genres de végétaux fossiles*, 1840, *extrait du Dictionnaire Universelle d'Histoire Naturelle.*

zoology (for he has many pupils) of a high order, as he teaches them to dissect and go into all the minutiæ. His enthusiasm is catching, especially when he has a good soil to work upon.

Believe me, my dear Bunbury,

Ever affectionately yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Berlin: August 8, 1850.

My dear Horner,—The Brocken Inn, where we slept four days ago, is a curious sign of the length of time that the Germans have been lovers of travelling for the sake of admiring natural scenery. It has been built fifty years, its foundations standing 3,500 feet above the level of the sea, in the latitude of London or thereabouts, and the spot being buried some nine months of the year under deep snow. It is solely for the pleasure of those who admire wild scenery, who like to take two chances of an extensive view from a summit usually enveloped in vapour, and to see the sun rise or set, if they cannot do both, as we did. I was very desirous of testing by an examination of this mountain the grounds of Von Buch's theory of the granite here having come up 'in a bubble,' and his singular notion that its dome-shaped form and even outline support this hypothesis. Now close to the said Brocken House is one of those tabular masses which we have at the top of many a Grampian Hill, of granite, and which corresponds to the Cornish tor, the rock decomposing in tabular masses. It is called the Witches' Altar, twenty feet high, and about two or three miles from this I found the Schnärcher, which I understand are mentioned in Goethe's 'Faust,' to consist of two magnificent tors of granite, the highest of the pair being 100 feet high, and showing unequivocally to what an extent *denudation* has gone, and how absurd it would be to imagine that the present surface is the original one of the mass of granite here exposed. Lonsdale's remarks, unpublished I believe, of the modern tors now forming in the granitic Scilly Islands, show how the sea is producing similar outstanding peninsulas or

'drongs,' as they call them, in the Shetland Isles. I have no doubt that the Devonian slates once enveloped the top, as they do now the sides of the Brocken. So much for this 'bubble.' Its indefatigable author is on a pedestrian tour in Switzerland, as Ritter tells me, so I have left my card only at his door. The upper chalk of St. Peter's Mount,[3] to go back to the beginning of this tour, is very beautifully displayed, and a young pharmacien of Maestricht, Bosquet, author of a paper on fossil tertiary species of Cypris, was an excellent guide, showing me where the change from our chalk fossils began. He and his master had a fine collection of shells, reptilians (monitor of Maestricht, huge turtles, &c.) to show us. De Koninck, at Liége, is a first-rate paleontologist, and gave me a great insight into the carboniferous and tertiary formations of the region. I was glad to observe between Aix-la-Chapelle and Cologne, how the railway-cutting exhibited the loess and its associated gravel and sand at the watershed between the basin of the Meuse and Rhine. But think of my surprise when I got north to the Porta Westphalica, and found, 500 feet above the level of the Weser, on the inclined oolitic beds, 700 (?) feet above the sea, a patch of loess, just like our old friend on the Rhine, and full of the three shells figured in my 'Elements' as the most common, *Succinea oblonga*, half freshwater, *Helix plebeia*, and *Pupa muscorum*. Strombach of Brunswick, and the elder Roemer of Clausthal in the Hartz, were much surprised to hear of this find of mine. To explain it will, I suspect, require some changes of level which have not entered into the calculation of many here, who think the Scandinavian drift of the Northern plains the last geological phenomenon of importance to be accounted for. Charles Bunbury will be interested to learn that the newest examination of the shells of the six divisions of the Devonian of the Hartz leads Roemer to think that none of the older beds (slates, limestone, &c.) of this chain are so new as the coal. Sedgwick and Murchison thought the uppermost of the divisions might be carboniferous. Now in this are numerous plants, Lepidodendrons, one Astrophyllite, Calamites, but all save one Calamite perhaps, of distinct species. This would help to confirm Goeppert's view as to

[3] Near Maestricht.

the specific distinctness of his Silesian flora of the Old Red. Goeppert has lately seen the Hartz flora, and says the *species* are not carboniferous. This would harmonise well with the close analogy in generic types, and the distinctness in *species* of the fauna of the Old Red when compared with that of the coal. An excursion with Strombach to an anticlinal axis called Asse, near Brunswick, was most instructive. It is clear that the keuper and chalk were formed in connected basins extending from England to North Germany. So was the Wealden, which supplied first-rate shining coal for the steam-engines at Minden and elsewhere, our locomotives, 'Blücher' and others, which carried us along twenty miles an hour over the vast drift-covered and sand-covered plains of the 'übergeschwemmtes land.' Yet ridicule was thrown by us for seekers after coal in the Wealden, where the limits of the same vast delta existed. The needles of a pine are as manifest in some of this Hanoverian Weald coal as are ferns, Sigillariæ, &c., in the older Stein coal. As to the botany of the Hartz, it seemed a tame affair after the White Mountains, and it was impossible not to compare them as we rode up from a woody region to a bare summit of granite covered with the same *Lichen geographicus*. The spruce fir, with scarce any intermixture even of birch, covers the hills, and up to the very top some dwarf trees are seen, or so near that I believe if sheltered they might grow much higher. At the summit a white anemone new to us was still sparingly in flower, and plenty of it in seed covered the ground. There are also *Trientalis Europæa* in fruit, *Galium saxatile*, *Gnaphalium* (*dioicum* ?) in flower, besides the commonest Lycopodium, *Lichen rangiferinum* and *islandicus*, with several *vulgar* plants, such as *Ranunculus flammula* and *Calluna vulgaris*, also the cranberry *Vaccinium*.

What most surprised me in the Hartz geologically, high and low, granite and limestone, marble or trap, whether at 700 or 3,500 above the sea, was the total absence of all glacial marking, whether polishing, or furrowing, or striation, or *roches moutonnées*, or erratics. Such a contrast to the southernmost part of Sweden or corresponding latitudes in North America! Yet some of the Scandinavian drift reaches the southern base of the chain.

I find there is Eocene tertiary under the drift in the environs of Berlin, and brown coal with palm wood under the Eocene shelly clay. I have seen the fossil shells.

Mary is sending a letter about more modern affairs. Ritter has just called again. Farewell, and believe me, with love to all,

Ever affectionately yours,

CHARLES LYELL.

To MISS CARRICK MOORE.

Dresden: August 3, 1850.

My dear Miss Moore,—I find that Mary is sending off a letter to you, so I take one of the sheets which we got on the summit of the Hartz mountains as a memorial of our having performed what was once a great feat; ascending to the top of the Brocken, which is covered with snow seven months of the year, and though in the latitude of 'The Cedars,'[4] presented to us a set of mountain plants agreeing for the most part with those with which we were familiar in the Grampians. It is 3,500 feet high, which to Germans accustomed to that endless plain which stretches from Bremen to the Oural, and which on our way from Berlin to this place we traversed in a north and south direction, may well appear a magnificent height. I was well satisfied to be carried by railway to near the foot of the Hartz, and by a carriage which carried all our luggage to the inn at the top, for by going up one road and descending by another, I was able to examine the granite of which it is composed, and other points of geological interest for which one has little time and courage when all one's energy and patience are required to contend with physical obstacles.

Our visit to Potsdam turned out most propitious, Humboldt giving us a good deal of his company and conversation and the *entrée* to the finest view from 'Sans Souci,' where the King was residing, not open to the public. The three palaces are certainly fine, and an oasis in a desert must always have a peculiar charm, so that the gardens pleased us much, and the great fountains 120 feet high, which I believe I

[4] Where Miss Moore resided, near Richmond.

could stand admiring as long as any child. But I confess that nothing pleased me so much as an exact restoration of one of the buildings of Pompeii, an atrium or outer court of a house, and a bath room, both of which form an integral part of the palace called Charlottenhof. These were erected by the present King[5] when Crown Prince, the bath being used. The court has no roof in the central part, and as it was a fine day, the blue sky, reminding me of Italy, had a beautiful effect. Looking at the beauty of the proportions of the room, and all the statues and paintings which adorned it, one could not but feel how little we have outdone the Greeks of a small provincial town, 2,000 years ago, in taste, even in the palaces of our days. The restoration also by Lepsius of one of the temples of Philæ on the Nile, in the museum, all the columns and walls being painted as on the original, a facsimile, only reduced to one fourth of the original size, is an excellent way of carrying one back 3,000 years. On the whole, however, the Berlin collection of Egyptian antiquities did not appear to me to be comparable in extent to that of the British Museum.

We go up the Elbe to Saxon Switzerland to-morrow. The weather both here and in the Hartz perfection. I sat long before the Madonna di San Sisto to-day, and can feel its beauty. The wealth of pictures is overwhelming to one who is not able to give weeks to them.

Believe me, with kindest remembrance to your father and mother and sister,

Very truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Liége: August 28, 1850.

My dear Horner,—I believe in my last letter I mentioned that I was going with Credner a geological expedition to try and determine the relative age of the loess of Thuringia and the northern erratics. He took me to critical points, and I returned with a quantity of new facts leading me to believe the loess to be for the most part posterior. As near

[5] Frederiek William IV.

Stuttgard the loess passes downwards in some places, as at Weimar and north of Gotha, into calcareous tufa and travertin, the latter being used as at Rome for a building-stone. This calcareous formation is from fifty to eighty feet thick, and I searched in it for gyrogonites, seeing many stems of Chara, and found them probably recent species, as the shells, freshwater and land, are of living species. But a great prize was a mass of tuff with four eggs, which I bought from the workmen near Gotha, perhaps of a tortoise. They are fixed in the solid rock, and were entire when found. They were fifteen feet deep in the tufa deposit, and in the same beds were bones of *Elephas primigenius*, *Rhinoceros tichorhinus*, *Ursus spelæus*, &c., and recent *Limnæa* and *Planorbis*.

The beds I have been fossilising in between Dresden, Weimar, Gotha, Eisenach, Cassel, Giessen, and Frankfort are triassic. The muschelkalk everywhere, as I formerly knew it at Baireuth. The keuper with Calamites, some growing like the East Virginian ones at right angles to planes of stratification; the lower member, the Bunter, usually without organic remains.

I was glad at Halle to be taken by Professor Giebel to pay my first respects to the roth-todt-liegende, or Permian conglomerate, and the contemporaneous porphyries out of the ruins or rolled fragments of which it is chiefly made. Again, at Eisenach, where there is a kind of section of the Thüringenwald chain, I found the Wartburg, where Luther threw the ink-bottle at the devil, is made of this same conglomerate 800 feet thick, and Charles Bunbury will be interested in hearing that the Psarrolites occur in the lower beds of the lowest member of the Permian.

With love to all, believe me ever affectionately yours,

CHARLES LYELL.

To CHARLES BUNBURY, ESQ.

11 Harley Street, London: September 14, 1850.

My dear Bunbury,—I am truly glad to hear not only of your botanising in the Urwelt, but also that you do not mean to let the plants remain for nine years more as unknown as they have been for the last nine million years.

When I met Colonel Codrington and Sir J. Wilson in town since my return, they said they could see by my looks I had been holiday-keeping in the country. So much for that whirl over the Scandinavian drift and Thuringian trias which seemed to you, when you read an account of it, as anything but a repose after London exertions. But when a man has had to write and print a book and Presidential Address, and dine and preside at the Geological Society, and carry on society, and an 1851 Royal Commission, all at once, you may conceive what a rest our tour must have been, though the grass did not certainly grow under our feet anywhere. We went to bed and got up with the sun, usually an explanation of my returning better and Mary fatter, which perhaps you will scarcely sympathise with, being like your late uncle (and as Audubon says the mammalia generally, considered as a class, are) a nocturnal animal. To give you an idea how far from easy it is to get at the repositories of treasures in your way, I asked everywhere for the names of Dresden geologists, and most people said Geinitz is the only man. At last, after writing to him, I learnt the name of an officer, Gutbier, whose work on Permian fossils I afterwards bought. He was quartered at Dresden. We arrived and I set off for Geinitz. Not at home. Lieutenant-Colonel Gutbier ordered out to a grand review before two Austrian Archdukes. Mrs. Geinitz assured me that there was not a soul, young or old, caring for stones or fossils in the whole city. Not believing this, I inquired diligently for dealers, and found there were two, who sold stuffed birds and insects. The first of these whom I beat up said he had no minerals, but once sold some to a teacher of painting, Professor Zeula. Off I went to where Zeula once lived, he had changed his abode; went off again. At last found him, an artist selling pictures and antiquities, and just going to lecture on painting, all very unpromising. But at last showing him my Anniversary Address, and making him aware that I was *somebody*, he gave me the overhauling of 200 drawers, more rich in well-arranged fossils, and among others Permian and German coal plants, than any I saw in public or private cabinets. He would, I think, have sold the collection, though he got them from a real love of geology. The moral of this is, never to believe that in any great

German city—and the same is true in France and the United States—there are no paleontological resources.

Believe me, with love to Frances, ever affectionately yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

London: 1850.

My dear Ticknor,—I believe I said that I thought Bunsen would lose his time in entering into the controversy about the Letters of Ignatius, but after a conversation I have had with him in which he gave me a sketch of the points in his new German pamphlet not yet translated, I have changed my mind.

He contends that the Syriac MS.[6] not only proves that the passages in the first three letters which were relied on as proving the Apostolic succession were spurious, but also that the four other letters which were an expansion of the interpolated passages were altogether forgeries. In short, 'the three Letters' translated by Cureton are all that Ignatius ever wrote. Bunsen has remarked that if Mr. Keble, our great Puseyite, could say in his preface to Hooker that it was a special intervention of Providence which led to the recovery of the Letters of Ignatius at a time when Episcopacy was in danger, what shall we now say of that Providence, which just at a moment when a certain party of the English Church are pushing the pretensions of the clergy to the verge of Romanism, has brought to light this MS. in the cellar of an obscure convent in the Libyan desert beyond Cairo?

Bunsen says that when the eight verses are omitted, the three letters are such as he might be supposed to have penned in prison (A.D. 107); but not so the other four.

I believe the Syriac MS. is of the fourth century. How early did these frauds and forgeries begin, and who shall say that all the three letters are pure and undefiled, or what degree of certainty have we in respect to the full and literal genuineness of documents still more important of which no MSS. earlier than the fourth and fifth centuries exist? I learnt with much surprise from Bunsen, *à propos* to forgeries

[6] Purchased for the British Museum from an Egyptian convent, containing the original Epistles of Ignatius.

and pious frauds of the primitive and mediæval Church, that Luther published the last edition of his Bible without the passages in St. John on 'the three heavenly witnesses,' but that soon after Luther's death they reprinted his Bible with them inserted. As they are wanting in all the four (?) older MSS. of the New Testament at Rome, as well as the Codex Regius at Paris, I have always considered it a great want of good faith on the part of the Protestants, that we distribute *millions* of Bibles without any mark to show to the multitude that these verses are spurious. Am I not right in saying that a great many, nay most of the Bibles used by the Unitarians at Boston, contain these verses without any italics or marginal note to show that they were interpolated? I presume that if this be the case, it would be defended on the ground that the Unitarians do, what our ministers do not, viz. explain that the passage is not genuine. It is precisely the same plan adopted here in regard to Moses and his geology. The vulgar hear the first chapter of Genesis read out without comment or the smallest explanation from ninety-nine out of a hundred pulpits, and they grow up in the belief of the modern origin of the globe, and the unity of the creation of man and the globe, and all the inhabitants which have ever lived upon it since the beginning. Hence they regard scientific men with suspicion and with prejudice, and yet no educated clergyman could now-a-days enter the field against the popular creed of the geologist or astronomer, any more than he would stand up and attack Erasmus or Porson about the 'three heavenly witnesses.' In short, in spite of the Reformation, the Bible is nearly as much a treasure in sacerdotal keeping as if we had all gone over with Newman to Rome; and in spite of Cureton, and Bunsen, and Blanco White, one is sometimes tempted to ask whether good faith and a regard for the sacredness of truth is not a rare exception to the rule in Anglo-Saxondom at least, whatever it may be in Germany. The sectarian spirit of the two divisions of the small Episcopalian Church in Scotland, the 'Drummondites' and their opponents, the High Church or Puseyites, is blazing out almost as violently as the old Kirk and the free Kirk; and then there is Romanism, and the new edict even of Pius IX.! against the excellent new Irish

Colleges intended by Peel to be open to all religious denominations; and the Wesleyans, who are now much worse than the Establishment in setting themselves against progress, and admitting no interpretation which Wesley did not sanction, although he, had he lived, would have moved on with the age. This and the narrow views of our dissenters, and the power of the English Church to substitute a sham national education for a real one, makes one almost despair. Even some of the most liberal of our clergy assume in their pamphlets that the labouring class will be made unhappy if taught too much, so they take care to confine them to the merest learning of their letters, and never allow them to think, paying schoolmasters thirty pounds a year in some places, wages which none of their men-servants, who are found in food, would accept. If the people, or the laity, should succeed in taking the matter into their own hands, as in your country, I should have some hopes, but I do not expect it. A few months ago the new King's College of London began a professional system of Divinity on the professorial plan, and forty-eight young men intended to graduate in London, and never to go to Oxford or Cambridge, immediately entered. I attach considerable importance to this move, as it is the first formidable opposition to or competition with the old Universities, and men brought up in the metropolis will have larger views. The clergy must continue to be our real educational rulers in this country, which I believe is more parson-ridden than any in Europe except Spain, if we consider how the higher education as well as that of the lower orders, and how the laity, as well as the clergy, are under the influence of this ecclesiastical body. Ten years ago, before Agassiz had been many months travelling here, he told me he thought the prospects of science in England very poor because of the power of the English Church, and I was surprised that as a foreigner he should have seen so far. The promotion of the new Bishop Hampden was well meant by Lord John, but he recanted so ostentatiously his liberal views, called by some Socinian, and he has done so little to distinguish himself, that few are much pleased with the nomination.

You ask me when I hope to get out any account of the

results of my last tour. I have only been steadily at work three or four months at the non-geological results of my nine months' absence from England, but get on fast, owing to having talked and thought it over with so many clever minds on the subjects which shook me. I have to steer clear of two errors,—first appearing to be too discontented with the state of things in England, especially as regards progress and education; and secondly, being too much an optimist about the corresponding parts of your system north of the Potomac or of New York city.

With love to your family, ever most truly yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

Mildenhall, Suffolk: December 29, 1850.

My dear Ticknor,—It is long since I have written to you, and I believe I owe you a letter. We are a large family party here of Bunburys, Horners, and Lyells, and the christening of my nephew[7] (also my wife's nephew) has been an event to mark our Christmas festivities. I am now writing my Anniversary Address as President of the Geological Society, and I then hope to be able to work at some original papers, the results of observations made on the geology of the United States in 1845–6, and last year in Germany, after which we hope to make another expedition of several months in Germany, that I may follow up a line of geological research broken off last autumn. You will see by the papers that there has been a great Church or ecclesiastical ferment here, I can hardly dignify it with the name of a religious excitement, for I fear the people are not, like the Scotch, enough in earnest. If they were, we should no doubt have an outburst of fanaticism and sectarian bitterness for a time, but it would lead to more religious liberty, such as you enjoy, and our statesmen and legislators would be more free to adopt a Government scheme of education, which must be very limited so long as we have 17,000 endowed clergymen, and 10,000 perhaps dissenting ministers, equally wishing to monopolise education. The Pope's rash move, or rather the

[7] Leonard Lyell.

insolent way of doing it, has roused the Protestant feeling of the middle classes, and the churchman sees that he must draw in his horns, and not lay claim to the supernatural power which our ordination service confers upon him of retaining and forgiving sins, than which no Catholic priest ever claimed more. So far, therefore, as tends to the checking of Tractarianism and semi-Romanist pretensions within the Church, this excitement, with all its intolerance, may do some good, but I fear it will bring about no reform in the Church creeds, liturgies, ordination services, and baptismal mystic rites, which a large majority of laymen look upon either as superstitious, or as forms of words which are to be gulped, or laughed at, or which, with a most worldly spirit of compromise, they contend for as a political badge.

Oxford and Eton continue to rear up men who pass through Puseyism to Rome, and the opinions of the higher and middle classes are getting more and more widely separated in religious matters—an effect which may one day undermine the Establishment, although its authors are aiming to increase their domination and supremacy.

Ever most truly yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

11 Harley Street, London : January 10, 1851.

My dear Ticknor,—I have lately been giving a lecture [8] to a large audience (gratis, and in a missionary spirit) at Ipswich, to more than 1,000 persons, on 'Geology,' one of the new provincial institutions, badly off for funds rather, but with a beautiful museum of natural history. Being on the surplus-fund committee of the Great Exhibition, I am in hopes of getting these provincial institutes connected with a central London Board, and that we may have examiners to grant certificates to be required of all who take places under Government, great or small. The Prince Consort is a host in himself in forwarding education, worth all the English Whigs put together. Oxford, and Puseyism, and Evangelism and a State Church, and the narrowness of excluded sectari-

[8] On White Chalk and Progressive Development.

anism, are fearful odds against us. If once the clergy see we are getting under weigh, they will try, and I fear with success, to get the mechanics' institutes into their own power, in which case the cause of science will suffer. But at all events, as yet, we are always moving onwards in the right direction here, while the rest of the Continent is retrograding, and the influence of Russian and Austrian semi-barbarism is felt as far west as Hamburgh, while France, to her shame, is strengthening sacerdotal despotism in Rome, as well as military power at home. At a large party of scientific men at our club the other day at dinner, it was said, 'We shall all have to migrate to America soon, as so many approve, even here, of Louis Napoleon and his Pretorian guards and Jesuits.' If Holland, Piedmont, Belgium, and the few constitutional states which remain free from Cossack influence, would join with us and the United States, it would be easy without a war, but at present it seems to us that the semi-barbarous nations are going to have it all their own way. You augured ill from the beginning of the French move in 1848, but you could hardly have anticipated such a result, and that, too, with a steady rise of the French funds. No one can now write a word on politics to a friend in Paris, and private letters from thence abstain from politics just as if it were St. Petersburg. Senior has returned from Rome even more shocked with the persecutions and dungeons there than Gladstone was with Naples. Never were so many of the best men imprisoned in all the more civilised countries as now.

As a set-off against occasional conversion of Puseyite Anglican clergy to Romanism, and people of rank and property, we have some thousands of Irish peasantry and farmers quitting Catholicism for Protestantism, and the Irish Romanist periodicals furious thereupon; also several instances of theological works of free inquiry in an earnest spirit, printed by men who are suffered to retain professorships in Universities, although so outrageously unorthodox that ten years ago they would have been sent to Coventry in society for entertaining or confessing such want of faith.

Remember us to the Prescotts and other friends.

Ever affectionately yours, CHARLES LYELL.

To CHARLES BUNBURY, ESQ.

53 Harley Street, London: April 22, 1851.

My dear Bunbury,—Heer's paper is most interesting to me, although 'Pereant qui ante nos, nostra dixerunt,' came almost to my lips when reading some of the pages. The first question is, how much faith one ought to have in his determination of the S. Jorge plants. The Corylus, for example, is it a hazel? He draws important conclusions from it, and the *Asplenium marinum*, on which he reasons.

The discussion on the former existence of an Atlantis is one on which I have made many notes and written much. It is very suggestive as treated by Heer, and better than I anticipated from his old essay on 'Madeira.' He does not appear to feel enough the contrast of the shells and plants, the forms so much more endemic and less European (I allude to the land-shells). It is really a splendid essay of Heer—allowing for future modifications. As I think I can prove that the islands, as islands, go back to the Miocene period, I feel the more interest in his speculation as to the original source of some of the plants from tertiary 'protoplasts,' as Dr. Latham would say.

I hope you will get a paper out or ready before I finish mine, if that day ever comes, for unless I fix the time I see that a life-time would never bring it about in the natural course of events.

Believe me ever affectionately yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

11 Harley Street, London: May 20, 1851.

My dear Ticknor,—Since I last wrote to you I have seen Mr. Lowell, who has come to see the World's Fair, with which he is as much struck and delighted as anyone. I arranged with him that I should give my lectures in Boston in the autumn of 1852, instead of the winter, as my scheme is to return in the winter for several reasons. . . . You will see by the papers which will reach you with the same steamer

as this letter, how wonderfully the 'Crystal Palace'[9] has taken, and how the prejudices of those who were incapable of taking in such a 'new idea' have given way before the tide of popularity and fashion. *We*, the commissioners, are now doing our best to give it an educational turn, but my hope is that the chief good will be the admission of the million to see so much of the result of the highest civilisation, such as even the aristocracy who have travelled to see palaces and museums cannot help admiring. Foreign nations in general have come forward handsomely, and have sent property to an extent which if estimated by the mere money value is really amazing. Turkey, Tunis, Egypt, and such distant points. To us, who know what the United States might easily have done, it is a matter of some concern that, if they sent anything, they should have done so little, especially after claiming so large a space. There are two or three good carriages and sleighs, and fortunately an Englishman sent Power's Greek Slave, which with your Bostonian Wounded Indian, is, I fear, the only two pieces of sculpture—an article which forms a fine part and feature of the Exhibition. But any one of the Atlantic cities might have sent a better turnout, and ought to do so now, were it only to show John Bull in the month of September, in the course of which several hundred thousand will still be crowding to Hyde Park, how much faster they have gone than the present contributions will give an idea of. Even now the Lyons people have only half their splendid silks and velvets unpacked, for they had no faith in our opening before the 1st of June. We have often been wishing that you and Mrs. Ticknor and your daughters were here, as we are staying longer than usual in town, to receive friends who are coming up to see the Exhibition. In the beginning of July we hope to get to Germany, *viâ* Belgium, to return in September.

Our nephew is gone with his parents to Scotland for a fortnight's visit to his aunts. We shall miss him, and my brother is to sail for India the first week in July, but I hope for two and a half years' absence only.

Believe me ever most truly yours,

CHARLES LYELL.

[9] First Exhibition at Hyde Park.

To His Sister-in-Law, Miss Horner.

Ipswich: July 4, 1851.

My dear Susan,—I sat next but one at the luncheon to-day given by the President and Vice-President of the Ipswich Museum to Prince Albert. Airy, President of the Association, between me and H.R.H. One of the incidents during the dinner was the Prince saying to me, 'I will show you a geological illustration in your way; there is a glacier' (pointing to a huge block of Wenham Lake ice), 'and here is the stream proceeding from its melting, and you see where it is flowing to.' We all looked, and the stream was just pouring over the edge of the table-cloth into Henslow's lap, who, as President of the Museum, was sitting in the chairman's place. He had barely time to escape being wet through.

But now to my subject. After luncheon the Prince took me aside and said, 'Are you to be with us to-morrow at the Commission, when we want numbers, and have difficult jury business to decide? I told him I could not be sure. 'Then,' said he, 'I must ask you to get, if you can, from your sister, a copy of that statement of hers.[1] I am sorry I have mislaid it; I have hunted for it in vain. Tell her if she will only put the *facts* fully, it will do. Evans is now at Venice, and we shall have lost no time. But to ensure a report I must put the affair in hand before I leave town.'

You may therefore, if you have not a copy of the original (which I do not think was too long), make a shorter one of the facts of the case as to the danger of destruction, &c. That is the pressing part of the business. But still a word or two about their being so badly shown would be useful, I think, and the cold and discomfort to artists in winter.

I am sorry you should have to re-write it, but we have at least the satisfaction of thinking it is not forgotten.

Believe me, my dear Susan, ever your affectionate brother,

Charles Lyell.

[1] Miss Horner had drawn up a statement of the danger and injury to Raffael's cartoons at Hampton Court from damp and fire. They are now in Kensington Museum, and under glass.

CHAPTER XXVII.

FEBRUARY 1852–NOVEMBER 1854.

DEPARTURE FOR AMERICA—ELECTRIC CABLE—GEOLOGY IN NOVA SCOTIA AND NEW BRUNSWICK—VISIT TO SIR EDMUND AND LADY HEAD—EXPEDITION TO VERMONT—NEW YORK EXHIBITION—VISIT TO OSBORNE—MADEIRA—GEOLOGY—WONDERFUL ORCHID.

[Sir Charles Lyell sailed for Boston in August 1852, to give a course of lectures at the Lowell Institute, and returned to England before Christmas.

In 1853 he was invited by the Government to accompany Lord Ellesmere as one of the Commissioners to the New York International Exhibition, and in consequence of the illness of his chief, much of the official business and representation of the Commission fell to his share. He returned in July, and in the winter went to Madeira with his wife and Mr. and Mrs. Bunbury.[1] Early in 1854 he visited Teneriffe, the Grand Canary, and Palma, returning to England in April. He attended the British Association at Liverpool the same year.]

CORRESPONDENCE.

To William Grove, Esq.[2]

11 Harley Street: February 14, 1852.

Dear Grove,—I heard the whole of your lecture [3] from a distant part of the room well and distinctly, and with great delight. It could not have been better or clearer, so far as the making an abstruse question comprehensible was concerned, and the exordium and peroration were beautiful.

[1] Lady Lyell's sister.

[2] Sir William Grove, Judge of the Court of Common Pleas, author of the *Correlation of the Physical Forces.*

[3] At the Royal Institution, the previous evening, February 13, 'On the Heating Effects of Electricity and Magnetism.'

As to the latter, I cited a letter of Liebig once on 'English Utilitarianism,' and you cannot put down too often the *cui bono* objectors. But you did more by taking the very highest ground in doing homage to the martyrs for truth. The extent to which the concealment of nearly all the newly discovered truths in every branch, moral and physical, is defended, if opposed to the popular notion, is one of the worst vices of the times, against which the shafts of satire should be aimed.

Speaking of martyrs, do you remember the low tone of morality with which, in a letter cited in Sir S. Romilly's Life, Mirabeau, with all his characteristic force and eloquence, apologises for Fontenelle. 'He well knew,' he says, 'that philosophers do not multiply like fanatics under the axe of the executioner or in the dungeons of the Inquisition,' &c., and went on to show how slowly and cautiously 'truth should be unveiled.'

Ever yours truly,

CHARLES LYELL.

To WILLIAM GROVE, ESQ.

11 Harley Street: May 30, 1852.

My dear Grove,—I was much obliged to you for your note. We worked very hard for three or four hours on Saturday, and greatly improved the Report.[4] Do not criticise too much what we do, but lean to the indulgent side, seeing that the great point in striving to get up a University for the people, is to approach it in the shape of industrial instruction, and if we can through certain influences get Lord Derby to join (and this I expect you will see done), much good must follow. The Church has of course an exclusive right to *educate* the people, but the humbler task of *instructing* them may, however reluctantly, be conceded to laymen and statesmen, provided the latter proceed with due caution and courage. The

[4] It was desirable to get a union of the principal Scientific Societies, and this movement ultimately led to the juxtaposition of the Societies at Burlington House. Mr. Grove gave evidence before the Oxford University Commission (to whose Report the above letter refers), recommending more instruction in physical science, and the making an elementary knowledge of it an integral part of University education.

individual independence of the Royal Society, &c., if they move to a new site, must of course be guaranteed, but I confess I regard this as of most importance (I mean the juxtaposition) to the getting some system and organisation into the schools for the people. We must not be too nice about the machinery for the first movement. The weak part of the Oxford Report is the not saying more about physical science; but it is a really grand Report, and all would follow if what they recommended were adopted.

Ever truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Government House, Fredericton: September 12, 1852.

My dear Horner,—In the steamer I had much pleasant talk, not only with the Heads,[5] but with several other messmates. The Americans seem all to agree that the vast German emigration pouring now into the United States is giving them a much more respectable and orderly population than the Irish, besides the advantage of being chiefly Protestant. Mr. Gisborne was on board, who has already manufactured a rope for an electric telegraph, to be laid down this season from Nova Scotia, by Prince Edward's Island, to St. John's, Newfoundland, whence a steamer will go in five and a quarter days to Galway, so that it ought to be possible before the end of 1852 to send a message from New Orleans to Vienna in five and a half days. Some money has even been subscribed for a rope 1,600 miles long from Newfoundland to Galway. But even Gisborne said that though he had subscribed largely himself, he would recommend no friend to do so; though he says the whole line would cost no more than two miles of the Box Tunnel.

I hired a pleasant private carriage with a pair of steeds, to take me and Dawson[6] on the way to Truro, eighty miles from Halifax, changing horses about every twenty miles, on

[5] Sir Edmund Head, Bart., born 1805, died 1868; eminent classical scholar and devoted to art, on which he published several works. Lieutenant-Governor of New Brunswick in 1847, and in 1854 promoted to the Governor-Generalship of Canada.

[6] J. W. Dawson, Esq., now Principal of Montreal College.

an excellent road, through natural woods, with very rarely any house in sight, and bright sunshine, my companion knowing the names of all the plants, and showing me among other things the great ridges of huge boulders, six feet and upwards in diameter, which the ice heaps up round the borders of the numerous lakes of clear water which we passed in a region of quartz, slate, and granite. We got out for a few minutes to visit five wigwams of Indians, beautifully roofed with birch bark. There are 2,000 of these Indians of pure breed roaming over this wild country, and after returning to the carriage I could not help wondering that this scene was within eleven days of my having walked the streets of Liverpool, after what was complained of as a longish passage, with a fair share of head-wind, in the least fleet of the new steamers of Cunard's line. I felt much fresher for the fallow which the voyage had given to my mind after the excitement of London. I was going to peep into the wigwam, when a curtain was hastily drawn, and Dawson warned me against intruding on the Indians uninvited, as they are very ceremonious among themselves. A Baptist missionary who was master of their language and gained many converts, was expounding lately the parable, that when you are asked to a feast you should take the lowest place, &c., when an old Indian remarked, 'It is strange that Christ should have spoken so to the white people. When a stranger enters our tent, he sits himself down by the door, and if we welcome him, we entreat him to come to the other side of the fire, farthest from the door. But the white men will come in unasked, or, if invited, will seat themselves without ceremony in the best place.'

Next day, *September* 2, I crossed between Truro and Amherst, the Cobequid Hills, by a different route from that which I followed with Mary in 1842, and more picturesque, displaying a great quantity of hard wood under which the fern and 'sweet fern,' *Pteris aquilina*, and *Comptonia asplenifolia*, were growing together, which they do not in the White Mountains, having there two distinct zones. I was amused at seeing good-sized schooners of 40 tons, building high up on the hills, 200 and 300 feet. In the winter a strong team of oxen will easily draw them down over the snow into the

Bay of Fundy. Imagine them buried by a landslip, a future geologist proving by them the change of sea level! It is marvellous to see the larch posts of the electric telegraph scaling the mountains, and serving all winter, though trees are blown down upon it every great storm. It is instantly repaired, and pays a very great interest for the capital expended, and in this 'sparsely' peopled country! My horses were ordered by it, and whenever I went into an office I found a string of messages waiting to be sent on: *e.g.* 'The ship "Anna" sails from Truro at 12 A.M., Thursday.' They also effect insurances of vessels at New York in a few minutes, giving the tonnage, &c., and receiving an answer from the Insurance Company. Dawson, the first evening, told his wife 'all well,' and asked if a child who was not well was better. The answer could not be given at once from Pictou, because part of the news from Europe brought by the 'America' with us, was still streaming through the line to various parts of Canada and the United States, but while we were at tea the reply came, 'Go to the Post Office and you will find a letter from me.'

On the Cobequid Hills the red maple had already begun to turn to a brilliant scarlet. The ground was covered with *Kalmia* and *Rhodora*, both out of flower, the latter a kind of Rhododendron, with bluish green leaves, and said to be beautifully purple in spring when in flower. The asters, golden rods, and everlastings, cover at this season all Nova Scotia and New Brunswick.

J. W. Dawson has for the last two years been a sort of school missionary paid by the Government. He showed me a room at Truro, where he met and lectured to eighty schoolmasters, convened to exchange ideas and for mutual instruction. No hindrance arises in these schools from sectarian differences, they are free to all denominations, but all attempts to make progress in the higher education at the college has failed, owing to the Legislature having divided the money among a number of sects, each unable to pay qualified professors. Luckily, when this system began, the schools for the people had not been started, so they determined to profit by experience. One of the last endowed colleges, that of Fredericton, New Brunswick, is rendered

useless and almost without scholars, owing to an old-fashioned Oxonian of Corpus Christi, Oxford, having been made head, and determining that lectures in Aristotle are all that the youth in a new colony ought to study, or other subjects on the strict plan which might get honours at Oxford. I trust that Sir Edmund Head may succeed in his exertions to get something taught which the pupils can afford to spend their time in learning. At present they must go to the United States.

My companion, J. W. Dawson, is continually referring to the curious botanical points respecting calamites, endogenites, and other coal plants, on which light is thrown by certain specimens collected by him at Pictou, and sent to Charles Bunbury. He told me that the root of their pond lily, *Nymphæa odorata*, most resembled Stigmaria in the regularity of its growth; and Dr. Robb showed me a dried specimen, a rhizoma, which being of a totally different family and therefore not strictly like, still suggests the probability of the Stigmaria having grown in slush in like manner, and sent out rootlets. I was much pleased to see two Sigillariæ dug out with their four dichotomous roots, each again dividing. It requires more labour than most geologists have time for, to have the whole disinterring and washing of trunk and root, allowing for occasional failures owing to the external marks being occasionally wanting, especially if near the base of the trunk and first starting off of the roots.

Dawson and I set to work and measured foot by foot many hundred yards of the cliffs, where the forests of erect trees and calamites most abound. It was hard work, as the wind one day was stormy, and we had to look sharp lest the rocking of living trees just ready to fall from the top of the undermined cliff should cause some of the old fossil ones to come down upon us by the run. But I never enjoyed the reading of a marvellous chapter of the big volume more. We missed a botanical aide-de-camp much when we came to the tops and bottoms of calamites, and all sorts of strange pranks which some of the compressed trees played. The so-called flabellaria, which I believe C. Bunbury thinks are the stipes of ferns, puzzled us much. They abound

most with Sigillaria. The underclays with Stigmariæ are wonderfully like those clays with recent roots under peat, and sunk stumps, in the marshes of the Bay of Fundy.

The names which the sailors have made out of the original French settlers' names are amusing. Point Demoiselle is Muzzle Point; Mont Chapeau Dieu, so called because usually capped with cloud, is Mount Sheepoddy; the great river Petit Codiac is Petticoat Jack. But I have met with none to rival an old friend in Musquito Bay, on the St. Lawrence, Anse de Cousins, which is 'Nancy Cozens.'

After the Joggins we returned to Amherst and thence to Dorchester, where a friend of Head's, called by some his prime minister, Mr. Chandler, received us in a handsome house, and his son took us next day to see a wonderful bed or vein of asphaltum, the subject of a hotly contested lawsuit—a vein from one to eleven feet thick, of pure pitch coal, or something like it, traversing fractured coal measures. It is too puzzling to attempt an account of it. As Gesner has consulted me, and the other party Dawson, we are trying to persuade them to compromise the suit. About 3,000*l.* pocketed already by the lawyers! The chief point being, whether it be a bed of coal which passes by a crown lease, or of asphalte or some mineral which would not pass. Many of the most eminent of the scientific chemists and geologists of the United States examined. The distances are enormous. After Dawson left me at Dorchester, I travelled about 150 miles at one stretch in a stage coach towards St. John's, New Brunswick. Chandler and two friends, good company inside. The population returns just made show that New Brunswick, which nearly numbers 200,000 souls, has increased in the last ten years faster than the average of Maine, Massachusetts, New Hampshire, and Vermont, the four adjoining States. Nova Scotia is about 280,000. Both big enough and fertile enough to hold as many as Ireland—noble provinces. They lose many of their most enterprising colonists by desertion to the States, and say 'we must get railroads in order to keep them.' Many are off to Australia and California. Still they grow 23 per cent. in ten years. Sir E. Head met me at St. John, and we examined the Falls together. It is very strange to

see a great river or tidal current, rush first in for several hours, and then out of a narrow gorge formed of metamorphic rocks, vertical beds of limestone and slate, invaded by trap and syenite. They ought to be called the Rapids rather. The vessels, a little fleet laden with timber, wait till the tide flows neither way, and then sail in or out. The whole harbour is beautiful. The sail up the river eighty or ninety miles from St. John to Fredericton is fine—picturesque, till a country of nearly horizontal coal measures produces tame outlines and low hills. The power of ice is ever present to me in these regions, transporting huge boulders in winter. The sea-ice carried an enormous angular mass of coal grit, twelve or more feet in diameter, from an adjoining promontory to the place where the colliers loaded. They were obliged to blow it up with gunpowder at low-water this spring. Our stay at Government House was very agreeable, and made up in some degree for losing the Heads for the last four years in town. He has many difficult points to grapple with in his colonial management, but Lord Grey supported him well. He is evidently much liked as Governor. We saw the Puseyite Bishop who had preached to us on board the 'America' enter, carrying a crozier in his hand! No one at home has yet ventured to perform this play, for which he cites an ordinance of Edward VI., in which I am told there are other popish ceremonies ordered which are not yet ventured upon.

I believe I mentioned in my last that Dawson and I found the skeleton of an animal in the middle of one of the upright trees of the Joggins, Nova Scotia. I thought it would prove a Labyrinthodon, and not a sauroid fish. Agassiz has seen the jaw, and what I supposed the humerus. He says it is something quite new, but he inclines to believe it will turn out something ichthyic. Dr. Wyman had a long work with me at it yesterday, and after he had begun by thinking its reptilian characters predominated, he ended by inclining the other way. He and Agassiz are to confer to-day upon it. On the whole, I fear it will not prove reptilian, though a remarkable fossil, and certainly in a strange place Agassiz is looking well, and preparing to publish a great embryological work on 'Paleontology.' He says 'he has

revelled in the sea here.' The French Academy have voted him the first prize bequeathed by Cuvier, for having done the most since Cuvier's death.

With my love to dearest mamma and her daughters, and to the Bunburys, believe me ever affectionately yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Boston: October 30, 1852.

My dear Horner,—Since I wrote to you last I have made a geological expedition into Vermont, as I believe Mary mentioned in her letter, where I found a tertiary brown coal or bed of lignite, nine feet thick and very pure, associated with white porcelain clay, just as in many parts of Germany, near Leipzig, &c. No fossil shells, but I hope the fossil fruits may enable Charles Bunbury or some one to decide its age. I never saw before in the United States any deposit quite like it. I am going to give a lecture on some remarkable trains of huge erratics which attest in the west of Massachusetts, in lat. 42, what wonderful power the ice, I believe coast-ice, has exerted. James Hall[7] and I worked five days at it, and I think we can explain the manner in which the wind and currents distributed them in certain linear directions. Even in the neighbourhood of Boston, I have been doing with Agassiz, Dr. Gould, and to-day with Strepson, a young engineer and conchologist, some good work, but I have not time to enter into it. The discoveries of Agassiz in the Florida reefs will delight Darwin, and I shall have much to tell him. Meanwhile, if you see Charles Darwin, tell him that in Florida the effective reef-building corals do not build lower than about sixteen fathoms; so he was much within the mark. Agassiz believes in subsidence and the atoll theory. He saw one spherical individual of Porites fourteen feet diameter! and thinks its age, and that of some Mæandrinæ, as vast as Ehrenberg thought.

Agassiz has in MS. sixty monographs on embryology of marine creatures, invertebrata. He confirms in most things

[7] Mr. James Hall, Director of the Government Geological Survey of New York.

the observations of Sir John Dalzell, where he has been on the same ground. He has upset all Ehrenberg's Infusoria, some are Vermes, some Crustaceans, some plants, some spori of plants, &c. And what, I asked, are Infusoria? The reply was, 'There are no such beings!'

October 31.—Mr. Peabody, a Unitarian preacher in King's Chapel, gave us a fine discourse to-day on the death of Daniel Webster, very simple and original. He dwelt on the great importance to a nation of a commanding intellect, as even those parties who differed entirely in their political views had the advantage of seeing every great question placed in a clearer light and on broader grounds, so that they were forced in opposing them to do so less ignorantly. There was no hyperpanegyric—which of course there has been in the various speeches made here. The union of all the distant States, and sects, and political parties, shows how national this country is. 'Uncle Tom's Cabin' will, I hope, do more good than harm on the whole. It is a gross caricature, because the very great number of kind masters, and of families where the same negroes remain for generations, is carefully kept out of view. But all the evils described, or nearly all, do now and then occur in a population of nearly four millions. As to Congress, it can no more interfere constitutionally than our Government to reform the harems and other abominations in Turkey.

My class is a very satisfactory and steady one, and being twice as great as has been seen in the Lowell Institute for many years, gives pleasure to its patrons.

Ever affectionately yours,

CHARLES LYELL.

To J. W. DAWSON, ESQ.

Boston: November 6, 1852.

My dear Sir,—I have very good news to tell you. Agassiz only conjectures that hollow-tree Joggins animal is a cœlocanth fish, possibly allied to Holoptychius, and assuming it to be a fish, then the remarkable bone which first struck us, and of which there are two, must be a hyoid bone because it could be no other. Yet he knows of no hyoid bone like it.

You see how very loose a decision this is, when the materials are so ample. Wyman begins to suspect an ichthyic reptile allied to Siren, *Proteus anguinus* (Nemobranchus?), &c., as he says there is a bone in them more like it. So much for our principal skeleton. But you will be delighted to hear that in the same stone Wyman has worked out part of a vertebral column, seven vertebræ in a series, and three other detached ones of the same dorsal and lumbar region, belonging to a distinct creature, and which he at once pronounced a salamander from the articulating surface of the ball-and-socket joints, &c. Afterwards, when it was shown to Agassiz, he exclaimed, 'This is more reptilian than anything I ever saw in the coal!' I now begin to regret that we left a single fragment of the stone on the beach. For Wyman worked this treasure out of a most unpromising stone, like many which I threw away.

Latest intelligence.—Dr. Wyman has just been here with great news. The first bone which we found is clearly not the hyoid bone of a fish, but the iliac bone of a reptile. Do not say anything about it, as every hour he is advancing. The iliac bone is so precisely ours, and the hyoid of a garpike (the nearest which Agassiz could find) is so very *unlike*, that we may pronounce ours to be a true ichthyic reptile till he can gainsay us. So we have two reptiles according to this, and as only four individuals were previously known in the coal of the whole world, I hope we have added 33¼ per cent. at one stroke to the reptilian paleontology of that era.

Believe me, my dear sir, ever truly yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

11 Harley Street, London: February 17, 1853.

My dear Ticknor,—I must add a few words to my wife's letter to Mrs. Ticknor, though my head is rather too much occupied with geology to have anything else worth telling of. My publisher is seriously thinking of an edition of 5,000 copies for this, the ninth, of the 'Principles of Geology,' with which I am very busy. Macaulay says that Longman

told him that in England more than a million copies of 'Uncle Tom' have positively been sold, far exceeding in popularity—what think you, the 'Pilgrim's Progress' or Walter Scott?—not at all—but James' 'Anxious Enquirer'! of which I at least never heard before. This perhaps explains far more of the run of Mrs. Stowe's book, than either its talent, or slavery, or the charm of reading a new picture of life, after our own social state has been hackneyed in so many novels, good and bad. It is, in fact, the first book which ever hit precisely the taste of the religious world and of the profane; 100,000 they tell me have sold of the 'Wide Wide World,' and half that number of 'Queechy.' One small printer who bought of Clowes the paper intended for the Exhibition Catalogue (the privileged one) which was a failure, and got it cheap because of its unusual shape, when paper was not easy to get, cleared 3,000*l.* by 60,000 copies of 'Uncle Tom.' Murray ascertained this.

So now everyone is speculating in American reprints, good, bad, and indifferent. They are poured in upon us like gold from Australia.

Ever most truly yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

11 Harley Street, London: April 26, 1853.

My dear Ticknor,—I wish to make to you the first announcement of a sudden change in our plans, by which we hope soon to have the pleasure of again seeing you and other friends on your side of the water. About a week ago, Lord Granville (President of the Council and Vice-President of the Royal Commission for the Exhibition of 1851, which still subsists, and of which I am a permanent member), called here to say, that the Government had determined to send out commissioners to the New York Industrial Exhibition. That it was somewhat contrary to etiquette, but that they were ready to waive that, inasmuch as the last Government of the United States had partially recognised the New York scheme as national. Lord Ellesmere had offered his services to the ministry, and they had thought of

me as No. 2, both to represent science and 'as one who would be acceptable to the American people.'

I told him I must take time, at least a day or two, to consider; for unless I could calculate by great exertion to get out my ninth edition of 'Principles,' now eight months out of print, I could not go. I must also, I said, see the instructions, and I stipulated that if I went, I would not undertake any share, much less a superintendence, of the Report. Secondly, that I would serve, like Lord Ellesmere, without any salary or pecuniary remuneration. These terms being agreed upon and put in writing by me in a letter to Lord Granville, and shown no doubt by him to Lords Aberdeen and Clarendon, from whom he brought the message, I was nominated, with leave if I could not be ready for the Government steamer in which Lord Ellesmere is to go, to take a mail packet, in which I might sail with my wife.

I also bargained that I might return as soon as the New York business is over, as my scientific work, to be cleared off before sailing for the Canaries in the autumn, will be much interrupted by this affair. In short, I give them two months in all of my time, in return for what is considered here a great compliment usually. Some of your countrymen here protest that the whole New York affair is a humbug. But Ingersoll has sent in a note which confirms the ministers here in their friendly resolutions. The Italian sculpture, consisting of a hundred statues, is, I hear, beautiful, and stimulated no doubt by the sales they made here in 1851.

I had resolved that nothing should persuade me to interrupt my regular geological studies, but there are many inducements to make us accept this on such terms, and I shall be glad if you will tell Mr. Everett, Lowell, Winthrop, Abbott Lawrence, Hillard, and many others whom you think would be interested. My wife will tell Mr. Prescott, but not enlarge on the subject. I thought I might read to Lord Granville a pithy passage from your last letter about the state of parties—Pierce, Douglas, Cass, &c.—which was admirably fitted to show them that, politically speaking, this might be a good move, or could not fail to be, for it is done in a good spirit. Lord Ellesmere is, as you know, a most

accomplished man, and has really great knowledge and taste in the fine arts, and has a glorious gallery of pictures.

Macaulay is in an unsatisfactory state. Whether India or overwork, or both, have damaged his strong constitution, I cannot learn; but he seems to have grown very weak and ailing. But I hope he will rally.

Ever most truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Boston: July 11, 1853.

My dear Horner,—Lord Ellesmere's illness, and the uncertainty as to what I may be called upon to do in the event of his absence, has kept me in some doubt, but I hope still he will rally, as he usually does rapidly, and not disappoint the meeting, and this I expect will be the end of it. I find educational matters more eagerly discussed than ever, and a growing conviction that the whole system must give way, simply because with the doubling of the population and trebling of the wealth, students on the old foundations do not augment in number. They have cheapened education, but it will not do, and finally they are coming to the reluctant confession, that as a large part of the people will do without Latin and Greek, but will have science and modern literature, they must provide the articles they want.

In New England, at New York, and in Philadelphia, I heard precisely the same declarations, and they have been made at public meetings since my arrival. It is evidently a crisis. Fortunately they have neither mediæval endowments to render them independent of modern public opinion, nor ecclesiastical collegiate governments to prevent them from adopting a radical change. They are going to work in good earnest.

There are so many sectarian colleges, that it will be some time before any one grows big enough to subdivide sciences as they require.

Agassiz is quite recovered and at work. Dr. Leidy made professor at Philadelphia, aged only thirty-five, and a first-rate osteologist and comparative anatomist.

Ever affectionately yours,

CHARLES LYELL.

To His Wife.

Osborne : August 23, 1853.

My dearest Mary,—I made out my journey and voyage very successfully. The parterre of flowers was in great beauty, and the views of the sea in spite of cloudy weather very pleasing.

I got here between six and seven, and Lord Clarendon arrived alone just after. I was very glad to find that he was to be the Minister in attendance. As usual, he has made himself very agreeable. He has been reading Lord Ellesmere's speech in my paper, and likes it much ; the Prince is to have it by and by. At dinner we had, besides the household, Count Mensdorf, the Duchess of Kent's nephew, Austrian Ambassador to St. Petersburg. After dinner, when four of the household played whist, the Prince had a long talk with Lord Clarendon and me about the United States, foreign politics, and University reform. Very frank, and both going as far as I do in most things, and never clashing in sentiment.

The Prince then invited us to join the ladies and sit down at their table, and I was asked by the Queen news of New York doings, and made them merry with Soft-shell, Old Hunkers, &c., and gave an account of the Exhibition prospects, United States prosperity, &c.

I shall try and drive over to Ryde this afternoon, if the Queen and Prince drive out. Lord Clarendon has proposed returning with me to town, which will be very pleasant. How they are overworked ! We parted at a quarter-past eleven o'clock, and Lord Clarendon found, to his dismay, five red boxes with State papers from London in his bedroom ! He told me he had hoped the interval of salt water would have stopped them. I am enjoying myself much, and only wish you were here. It is a very pleasant residence, like a small German Principality palace.

Ever affectionately yours,

Charles Lyell.

To LEONARD HORNER, ESQ.

Madeira: January 1854.

My dear Horner,—I have been wishing to send you some account of my geological results in Madeira, but have been so actively employed in the field, that I have had barely time to write my notes each evening. Besides, I am continually modifying, and improving as I hope, my views of the structure of the island, which far exceeds in interest anything I had anticipated, as it does in picturesque beauty any region of equal extent I ever saw; Switzerland not excepted.

The sea-cliffs and innumerable ravines, both of great depth, display the rocks very finely, but the ravines and deep valleys make it a long affair to get from one spot to another, which looks an easy morning's walk. The horses can climb admirably, and even leap up a succession of rocky steps, to which I have now got accustomed, and feel safer than on my own legs.

My companion, Mr. Hartung,[8] is very zealous, and his agricultural, entomological, and botanical pursuits had made him in the last three winters get up the physical geography and language well, and some beginning of geology; so he helps me very much, and is an apt scholar. He also draws tolerably, and improves in this daily.

I have satisfied myself that Smith of Jordanhill was right in attributing a sub-aerial origin to the volcanic rocks of this island generally, although Vernon Harcourt has since disputed that opinion. I have now seen more than either of them did, and have visited the only part where marine formations are known above the level of the sea. They reach a height, not of 1,600 feet, as reported, but of 1,200, as determined by my barometer. I have found waterworn pebbles of the usual Madeira volcanic rocks in these same beds, which contain corals and sea-shells; such pebbles are entirely wanting in the volcanic breccias which all over the island contain angular fragments thrown out by explosions. There is one example of an impure lignite, and

[8] Mr. George Hartung, of Königsberg, author of *Travels in Norway*, &c.

a leaf-bed under basalt, in which I have been the first to find leaves; a greater mixture of ferns with dicotyledonous leaves than Charles Bunbury has seen in any other tertiary formation. He has found about five species of ferns, Pecopteris, Sphenopteris, Adiantites (?), &c., and has not quite examined all my specimens, most of which have been obtained for me by a peasant, whom I have kept at work ever since I found out the spot, which like most of the best geological localities here, is rather inaccessible. One really ought to have a tent, so much time is spent in going and coming back, but there is much to see upon the way, which makes up somewhat for the exertion. On the great question whether the Curral is or is not a crater, on which Darwin will be curious, I have made up my mind that it is not. In general this island confirms his doctrine, that if all valleys were cut by rivers alone, they would be very narrow, though they might be of any depth, and that the sea is the great widening power. The question then arises, whether the two principal central valleys of Madeira, the Curral and that of the Serra d'Agoa, could be as wide as they are if due to aqueous and fluviatile erosion alone, aided by the gradual upheaval of the rocks to the height of 1,200 and perhaps more feet, which the marine strata have reached, during which upheaval the original flattened dome has I presume acquired a more convex form, in accordance so far with the 'Erhebung's' theory, provided time enough be allowed for the uplifting. But I find the beds very much nearer horizontality in the central region, where they are highest, and the dip which they have from 3° to 7° is by no means always away from the central valleys, as stated to be the case in the Caldera of Palma. Besides, these central valleys radiate outwards to the sea, both to the north and south, unlike the case of Palma; the dome was of an elliptical form, as there was not one habitual volcano, but a chain of rents, like a miniature Andes.

In the middle or axis of the chain, sub-aerial volcanic matter, 4,000 feet deep, is seen to be piled up. The basalts accumulated between numerous cones of eruption, and then flowed away in all directions, occasionally encountering and burying lateral cones, some of which are exposed in the lofty

sea-cliffs. What surprises me is, that the sheets of basalt are scarcely, if at all, more inclined than at first, where nearest the great focus of eruptions, whereas they have a slope from 9° to 13°, and sometimes rather more, as they recede from it. Dikes are innumerable in the central region, and are fewer nearer the sea, unless where a transverse or north and south volcanic axis branches off, and presents on a smaller scale an epitome of the whole island. One of these, at Cape Giram, has its anatomy finely laid open by a nearly vertical sea-cliff 1,600 feet high, where I have counted 120 dikes, some of them running from the base of the cliff to the top. Even in this section the basalts are most horizontal where the dikes are most numerous. The modern rivers have left beds of pebbles 100 and 130 feet above the present channels; precipices which bound them are so steep that higher ones cannot be preserved, for they get undermined and fall down.

Believe me ever yours affectionately,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Lazzaretto, Santa Cruz, Teneriffe: February 21, 1854.

My dear Horner,—Although I have only time to give you a brief outline of the results of my last two or three weeks' work in Madeira, I must endeavour to do this before I am absorbed in this new field of interest in the Canaries. At last I found beds of pebbles, which I believe to have been rolled by rivers under currents of lava in Madeira, and like the fossil plants alluded to in my last letter, and more of which were discovered up to the last, these pebbles prove that there was here a volcanic island built up by a series of *sub-aerial* eruptions. I had also the pleasure of finding a set of trachytic lavas and tuffs 900 feet thick, at Porto da Cruz, all newer than an older and more inclined basaltic series, showing that one set of movements was over, and the erosion of one set of valleys completed, before some important portions of the volcanic operations had begun. Such conclusions you will see, respecting the north-east of the island, are in harmony with the different ages which I ascribed to the Cape Giram

beds in the south. I was able to prove by repeated visits to that grand sea-cliff section, that the juxtaposition of the highly inclined and the horizontal beds was owing to a great dislocation, but I must not dwell on that now.

Besides some beds of waterworn alluvial gravel covered by trachytic lava at Porto da Cruz, I found at Camera de Lobos, near Funchal, some tufaceous alluviums, with slightly abraded blocks overspread by layers of columnar basalt. But after a nine weeks' search, I never met with a single river bed with lava resting upon it, no old fluviatile gravel conforming to the present valleys, or even approaching to a coincidence of position with what are now the lowest levels upon which a stream of lava had flowed. I therefore supposed that Madeira during its growth was not like Auvergne or the Olot district in Spain, but like Etna, where there are no torrents or rivers or springs, not even in the Val del Bove, where the cattle have to be supplied with the water of melted snow, or like Mouna Loa in the Sandwich Isles, where a dome of much larger dimensions is, I think, described by Dana as without running water, though not without rain.

Von Buch saw but little of Madeira, or it would certainly have been regarded by him as a 'crater of elevation.' If the Curral, and the Serra d'Agoa, two great central valleys, be given up as craters, and regarded as valleys of erosion, still Madeira would resemble the Mont d'Or and the Cantal all the more for not having any great central crater. The existence of a marine deposit at one point north of the east and west axis, rising to about 1,200 feet above the sea-level, shows that here, as in the case of Etna and Somma, there has been upheaval in some shape and to a certain amount, and in Madeira, as in the case of the Neapolitan and Sicilian volcanos, the earlier eruptions were submarine, for the shells and corals are associated with rolled volcanic fragments and tuff. But besides this, there is such a tilting of some masses of solid lava away from the central axis as to imply that much of the principal movement was of a kind to cause the beds to dip away from the force of eruption, although, as I said before, there are large spaces at great elevations, from 2,200 to 5,000 (?) feet high, where there are plateaus at or near the centre of the island, where the beds

of basalt have a slight dip, not more than I conceive they may have had originally. In this respect Madeira differs from Palma and Teneriffe, so far as I know the latter by Von Buch's descriptions.

A great proportion of the dikes are older than the inclined basalts, and others as old, and it would seem something of a paradox if we found that the grand explosion and upheaval was reserved till all the ordinary volcanic energy was spent, although we might perhaps imagine that when the safety-valve was closed, the subterranean force might expend itself in uplifting and injecting the rocks below. Let us see then whether we can reconcile the different theories of the eruption and elevation schools, so that by the aid of both we may account for what I have regarded as facts of a conflicting character. In the first place we have abundance of evidence that had there never been any elevation whatever, Madeira would have been a lofty island about 4,500 feet high, formed by a long series of supramarine eruptions which gave rise to mountains more than 4,000 feet high, consisting from top to bottom of volcanic tuff, and breccias and scoriæ, lapilli, cinders, and lavas, and slightly inclined basalts flowing away in all directions, east, west, north, and south, for miles, perhaps far beyond the present limits of the isle, and not below the sea. I have fossils, leaves of ferns and dicotyledons (more than 150 specimens) showing that before the island was formed, it was clad with vegetation. In the Curral we see very deep into the interior, to within 1,700 feet of the sea-level, and that in the middle of an island above 6,000 feet high. No signs there of any corals or shells, or such wearing or rubbing off of the angles of the stones included in the breccias as I invariably found in the Porto Santo and S. Vincente marine volcanic conglomerates.

This hypothesis, therefore, of the upheaval of the island, so far from explaining its structure, would involve us in many perplexities. In the first place there are no raised shingle beaches, no tuffs containing sea-shells, a leaf bed only 900 feet above the sea-level covered by tuffs and lavas 1,200 feet thick, &c. Mr. Smith's [9] suggestion that some parts of the coast of the isle have sunk since the volcanic period would

[9] Of Orotava.

perhaps explain much more, but I will not at present discuss that view.

The conclusion to which I am coming is this, that there has been a prodigious succession of periods of volcanic eruption both along the central east and west axis of eruption, and along certain north and south lines, and finally, and at a later season, along the coasts. In this small chain, thirty or thirty-five miles long, as in the greater one of the Andes, all the volcanos were not active at the same time. Some were extinct ages before others broke out; yet there was such a similarity in the products of all, and in the mode of rending, injecting, and dislocating the rocks already formed, that the general result throughout the whole chain was very uniform, the general structure and composition nearly the same, and the numerous local exceptions only discoverable after much study.

But I must conclude, for the arrival of the Cadiz steamer has made us determine to avail ourselves of its aid to visit the Grand Canary, and Mary, Mr. Hartung, and I go there to-morrow morning; but I shall leave others to send you all the news not strictly geological.

The climate of Madeira was like that of a good English summer, never too hot for work in the field, and never cold, even when one was wet with a shower. In the small grounds of the Lazzaretto here, over which we are allowed to walk, Messrs. Bunbury and Hartung gathered forty-eight wild plants in flower. With love to all, believe me ever yours affectionately, CHARLES LYELL.

To MRS. BUNBURY.

11 Harley Street, London: June 10, 1854.

Dearest Frances,—I was very glad to learn from your last letter to Mary that you had not forgotten the barometrical calculations.[1]

I received the other day a letter from Joseph Hooker from Hadleigh, in which he gives all his reasons for thinking Coniferæ as highly developed dicotyledons as any others, and above monocotyleds. In this he differs from Ad. Brongniart. Henslow sends word that he concurs. I should

[1] Made by Mrs. Bunbury in Madeira.

like to show the letter to your husband and get his criticisms. But it is a precious document, as I have to allude to the question when treating of the carboniferous flora.

Please send all possible objections to the views of Hooker and Henslow. It is curious that in a number of 'Silliman' just received, Agassiz, in a paper on ancient faunæ and floræ, asserts that they were at every ancient period as *varied* as now, but that the grade of the highest was not so high as now. The supposed fact of *all* the Stonesfield mammalia being marsupial made him despise the pouched animals. Afterwards Owen found the Thylacotherium (or Amplitherium) to be placental or monodelphous. Now a grand discovery has been made last Wednesday. Owen read a paper on a new Purbeck (Upper Oolite) mammifer, a new genus of the mole family, allied to *Talpa aurea* or the Chrysochlore of the Cape, allied also to Thylacotherium. Several perfect lower jaws with teeth in good condition, a true *non-marsupial* mammal.

Truly the oolite is looking up, and it is the more striking since the chalk (Wealden and all) still refuses to yield up any of its mighty dead, if it has any to disgorge, as I expect it has. But if not, it only shows that their absence is no argument that in older beds more advanced forms were not developed.

What does Charles think of Hooker's notion that there were some grasses in the coal? No doubt it would better suit the progressive theory if they came in long afterwards. It would be more orthodox that Nature should first try her hand at some easier feat. If I might paraphrase the lines of Burns,

> On ferns she tried her 'prentice hand,
> And then she made the grasses, O;

but I must really have done. The Duke of Argyll, at the *levée* yesterday, had a long talk with me about my speech at the Geological Society on Owen's paper, and he said, 'You will never get over the absence of mammalia in the coal which has been so well worked, and contains more dirt beds than the Purbeck.' This was a good hit, and, as I confessed to him, the strongest point on that side; but on negative evidence the coal was without land quadrupeds, birds, sau-

rians, chelonians, ophidians, land crabs, air-breathing mollusca (save two individuals which I found), insects, save three or four individuals, no helices, no lymneas or planorbis, &c. &c. In short, it proves too much when the marine fauna was so perfect.

Ever affectionately yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

11 Harley Street, London: August 12, 1854.

My dear Horner,—Edward Forbes is come to town for a short stay, and I must get out my Grand Canary and Madeira fossil shells to show him. Murchison has come out with a very useful book on 'Siluria,' well done, and much new matter on Coal and Old Red, as well as older things. I shall have to controvert one chapter on 'a long period when the invertebrate animals alone existed.'

I asked M'Andrew yesterday how many vertebræ or any remains of dead fish he dredged up on the Dogger Bank or the great 'Ling Banks' or cod-fishing grounds off Shetland. To my astonishment he replied, 'I never drew up one bone or tooth, though sometimes live fish came up in the mud. Once I got what I thought was a tooth of some vertebrate animal, but it proved to be of an echinus.' He imagines that future geologists will find no signs of the existence of fish in the sand and mud of the great fishing-banks of Newfoundland! Yet you remember in the 'Principles' I had a 'bone-bed' in the sea of the Hebrides, so we have an Upper Silurian bone-bed. Huxley is established at the Museum of Practical Geology; he is coming on fast in Paleontology. Elie de Beaumont was here for two days, and made himself very pleasant. He is looking well.

Ever affectionately yours,

CHARLES LYELL.

To C. J. F. BUNBURY, ESQ.

53 Harley Street, London: November 13, 1854.

My dear Bunbury,—I have been intending from day to day to write and thank you for your former letter, in which you gave me an account of the conversion of the Ægilops

into wheat, which I shall keep for next edition of the 'Principles.' Hooker seems to believe it, though in general not so prone as Lindley to entertain such ideas.

When we were at Charles Darwin's we talked over this and other like matters, and Hooker astonished me by an account of an orchideous plant[2] sent, I think, by Schomburgk from Brazil, and which on different branches of the same individual specimen contained flowers previously referred to three distinct orchideous genera, some of the said genera having had several species referred to them. You probably know about this, which will figure in C. Darwin's book on 'Species,' with many other 'ugly facts,' as Hooker, clinging like me to the orthodox faith, calls these and other abnormal vagaries. I think Joseph Hooker said that each of the three so-called genera, now resolved into one and the same species by Sir Robert Schomburgk's specimen, were morphologically distinct on many different points. I have learnt all I could from the Bury paper of your lecture, which was, I think, very well imagined, and not dry, as it might have been if too botanical. There are no end of desirable illustrations of plants, if one could set Henslow to work in his Michael Angelo style; a name rarely conveys an idea to a class without a picture.

Of my four species of Bryozoa from the Grand Canary, one is recent and three unknown, so says the first-rate authority, Mr. Busk. I imagine the age may be Miocene or falunian; but this is a mere guess as yet. The San Vincente sub-marine beds were volcanic, or contemporary with eruptions, whether upraised before Madeira existed as a volcano I cannot say. But as the mass of Madeira is of supramarine origin, this San Vincente bed must have been its foundation, I suppose. It is a good question. Porto Santo is strictly an analogous case, an upraised volcano of submarine origin, and a superstructure of sub-aerial lava.

Sebastopol is an anxious business. The lateness of the season is, I suspect, chiefly owing to Lord Aberdeen never having intended anything but a demonstration in the Mediterranean, and never in earnest. This I think I know

[2] *Catasetum*, described in the *Fertilisation of Orchids*, by Charles Darwin, and referred to in the *Origin of Species*.

through private sources. The Czar knew it, and did not budge, of course.

I hope to comply with your friend Lord Arthur Hervey's wishes [3] some day, not a distant one. Meanwhile I am very glad your lecture went off, as I fully expected it would, so well, and that you are going to repeat it. I am sure that what Dr. Franklin said of Wesley's field-preaching and extemporaneous discourses, that the most effective were those he had often given, so is it with lectures. Each time you will improve the same subject; you know better the value of the hour, and measure the relative importance and popularity of the subjects better, and waste no time in saying how little time you have, though I do not hear that you did so, but most men do.

With love to Frances, believe me, ever affectionately yours,

CHARLES LYELL.

[3] The present Bishop of Bath and Wells, who requested him to give a lecture at Bury St. Edmunds.

CHAPTER XXVIII.

JANUARY 1855—AUGUST 1856.

DEATH OF EDWARD FORBES—BERLIN—DR. HOOKER'S INTRODUCTION TO 'FLORA INDICA'—HUGH MILLER—ENTOMOLOGY—MACAULAY AND PRESCOTT'S HISTORIES—FOSSIL BOTANY—ON THE DOCTRINE OF SPECIES—SILESIA—RIESENGEBIRGE—BOTANY—GEOLOGY OF SAXON SWITZERLAND—BARRANDE'S 'COLONY' OF UPPER SILESIAN FOSSILS.

[In 1855 and the two following years, Sir Charles and Lady Lyell spent several months of each year travelling on the Continent, always with the view of geological inquiry. The University of Oxford, his Alma Mater, conferred upon him the degree of D.C.L. in 1854, and he attended the British Association at Glasgow that year.]

CORRESPONDENCE.

To His Sister.

53 Harley Street, London: January 2, 1855.

My dear Caroline,—I enclose a letter from Sir Walter C. Trevelyan of Wallington, supposing you must be the individual alluded to, who having found a rare insect, wished to keep the *habitat* to yourself. I wrote to say that we never kept it a secret, but that as I had given away all the duplicates I had here, I would ask you if you could send one or two to Sir W. Trevelyan, by post in a small box with cork, or as you think best, and I asked him to acknowledge direct to you their safe arrival, if safe. He alludes to poor Edward Forbes's death, which is indeed the greatest loss of an active scientific friend I have ever sustained, and as he was but thirty-nine, so unexpected. We are getting up two London memorials to him, to which I subscribe. His death and Mr. M'Ilvaine's of New Jersey, and Lord Cockburn's, are a great many in one year, and among geologists much

younger than myself, whom I often saw, Mr. Strickland, run over by a railway.

It makes one feel as one grows older much as the officers in the Crimea must feel, that they are surrounded by companions whom one may never see again, a few weeks or months hence, and it seems strange how little one is checked in one's own proceedings, and how one coolly purchases a lease of sixteen and a half years of this house.

With my love to all, and a happy new year, believe me your affectionate brother, CHARLES LYELL.

To GEORGE HARTUNG, ESQ.

53 Harley Street, London: January 21, 1855.

Dear Hartung,—Your letter, dated January 4, reached me several days ago. You make steady progress as a geological artist, and I think the view of Funchal and the S. Martinho range with Cape Giram and Pico Bodes range in the distance, is a particularly truthful sketch.

I chipped off with a small hammer, some three weeks ago, nine small fragments of rock, from as many specimens which I collected when with you, and sent them duly numbered in a letter by post to M. Delesse at Paris. No mineralogist and analytical chemist is perhaps so good an authority as he is. In a few days he sent back an answer, and had found, by aid of the microscope, minute crystals of all the minerals, larger crystals of which were in the big pieces I kept here. First I sent the 'yellow concentric' from Sitio do Poizo and another place, calling it basalt. He replies, we in France should call it basalt, but I did not expect that you would; as it is made exclusively of greenish felspar and olivine without any augite, 'therefore would you not in England call it trap?' Certainly I had imagined that the darkish grey colour was derived from augite, though I was aware that it consisted in great part of felspar. Other rocks, which I called basalt, he also named the same.

I hope when you return to London to know much more about the Madeira and Canary Island rocks. I shall send you a copy of my book with the report I have given of the result of our joint observations. It would be better for you

and me to see a country of recent or active volcanos next. But you are well employed in Madeira. Pray go to the Pico of Camera de Lobos and see the lava (?) or scoriaceous mass on the flanks of the hill which I often wished to go up to.

The Bunburys and Lady Lyell desire to be remembered to you. I will try and report in my next letter on the Grand Canary organic remains, some of which are curious.

Ever most truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Berlin: March 24, 1855.

My dear Horner,—We have spent our time very pleasantly and happily here.[1] I returned this morning from an expedition to the Kreutzberg to see the boulder sand and clay, which I think has undergone a good deal of rearrangement since it first began its travels from Scandinavia. My companions were Beyrich, Ewald, and Dr. Roth. One or two mornings' work with Mitscherlich have been very profitable. He, Gustave Rose, and Dr. Roth went to Vesuvius and Stromboli and Vulcano. At Stromboli those three men established the important fact, that from the modern crater of Stromboli have proceeded *continuous* streams of lava twelve feet deep and 100 broad, of dolerite as compact as the ordinary lavas of Etna and of exactly similar composition, and that the same lavas are now and have been from the first on slopes of 15°, 20°, and 29°. What shall we think now of Elie de Beaumont's and Dufresnoy's assertion that no *continuous* stream could form on the least of these inclinations.

Scacchi's account of the eruption of Vesuvius in 1850, and all that happened there between 1845 and 1850, a copy of which Mitscherlich lent me to read, is highly interesting, and quite unfavourable to Von Buch's theory and to Dufresnoy's facts and views. In one paper Scacchi is so astonished at Dufresnoy's assertions, who never walked once over one whole side of Somma, that he says in so many words, 'that if the French *savant* was ever at Naples, he could never have gone out of his house, or only by night.'

It is strange what influence Von Buch exerted, for he

[1] With Chevalier and Madame Pertz, Lady Lyell's sister.

has made both Ewald and Beyrich entirely disbelieve all the glacial hypothesis. The other day I told Mitscherlich I would convert them both, and he said (both of them being present, and laughing at the joke), 'No, you will never do that, for the one (pointing to Beyrich) is like a stone, and the other like india-rubber; you think you are making a great impression, and then find next day that up he comes again just in his former shape.'

Ever affectionately yours,

CHARLES LYELL.

To DR. JOSEPH HOOKER.

53 Harley Street: July 17, 1855.

My dear Hooker,—I have to thank you for your valuable volume on the 'Flora Indica.' Your introductory essay is a great treat, and I must study it carefully with reference to the 'Principles of Geology,' as I may some day have an opportunity of correcting and enlarging my views. I have also to observe that I was gratified at your note at p. 40, because Bunbury once told me that Henfrey, in some general work of his, had said that Edward Forbes was the first to strike out that line. I never thought it worth while to allude to this, as I have tried not to spend any time or words in making 'reclamations,' though, I suppose, that if my books had not had so large a sale, I should have given way to that weakness, as I see so many others do.

I am glad you have two full indexes. I would have put the whole into one. I am sure that, as a rule, it is best, however heterogeneous the subjects, to have one only at the end, for one finds a word easier in a large than in a short index, and one knows exactly where to find it. But this is a trifling matter in a volume which one sees at once is the result of such a vast body of new facts. The maps are most useful.

De Candolle has just sent me his two volumes, but I have not had time to look at them.

I have had a week's steady work in the Wealden district, studying the problem of 'denudation,' but I must conclude.

Ever affectionately yours,

CHARLES LYELL.

To Leonard Horner, Esq.

Shielhill: September 5, 1855.

My dear Horner,—You mention in your letter to Mary how much you were interested in Hugh Miller's 'Schools and Schoolmasters,' a biography every page of which we read with delight, though I quite agree with you in wishing he had kept to his prose. I found the man quite equal to my expectations from his books. I had always missed seeing him before, and narrowly did so this time, as he arrived in Edinburgh the day after us, after a three weeks' ramble. He welcomed me most heartily, and was entirely at my disposal for two days. and would have accompanied me longer, whether in the field or the museum, had I had time. His remarks on other geologists were very just, and his criticism also, with a generous appreciation of their merits. He is quite as willing to learn as to teach, and I got a great many new ideas, both in going over his beautiful collection, and in walking over Arthur's Seat and Salisbury Craigs. I had a walk to the top of Blackford Hill with Charles Maclaren, who was very well, and full of geology. Dr. Fleming has a notion of giving us something on Edinburgh, and I wish he would. I had two good talks with him, and a walk over the Calton Hill, and over the coast of Fife from Kinghorn to Kirkcaldy. I view the Edinburgh and Fife rock with very different eyes now, since Madeira and the Canaries. They are in part intrusive, in part *sub-aerial* in my opinion, in part estuarian, like the associated Burdie-house coal measures, which last are the lower portion of the coal series.

Ever affectionately yours,

Charles Lyell.

To Charles J. F. Bunbury, Esq.

53 Harley Street, London: October 6, 1855.

My dear Bunbury,—I am afraid, from a letter which Symonds has written to me this morning, that you have had rather more than an ordinary share of bad weather, but I hope you will make out a visit to him.

In Phillips' new edition of his 'Geology,' just out, he makes

the Lingula beds Cambrian, just as I do, which I am glad of, as, however Murchison may complain, it is really we that are adhering to the original divisions and names adopted by Murchison and Sedgwick. It would be wrong to give up the term Cambrian just when we are beginning to have a distinct fauna for it, as Salter was the first to show here, and Barrande in Bohemia. Sedgwick's attempt to take the Lower Silurian into his Cambrian is even worse than Murchison claiming all that is older than the Devonian as appertaining to his Silurian.

Tell Symonds that I yesterday had a talk with Murchison about the Dumfries beds. He says, when he first saw them he felt, as he does now, that no such sandstones, speaking lithologically, were ever seen by him in England or elsewhere in the true trias.

I am glad that Frances has made Mr. Symonds' acquaintance, and that she is enjoying herself.

Believe me ever affectionately yours,

CHARLES LYELL.

To HIS SISTER.

53 Harley Street, London: January 5, 1856.

My dear Caroline,—I am actually going to dine at Lady Coltman's alone, for Mary is not well enough, having been in bed instead of breakfasting with me, for the second time only since our marriage. There was something like an epidemic at Mildenhall, though certainly Leonard and Frank[2] were merry enough, and some others, but I presume that Harry and Katharine gave you the news of our merry-making there.

I was shocked to find poor Curtis[3] so nearly deprived of sight, and expecting to be soon quite blind; the night I met him there was a discussion at the Linnæan Society as to the cause of the very unusual number of moths, especially of the Noctua family, in the summer of 1855. President Bell, who is now proprietor of the house which White owned at Selborne, said that there had only been one-fourth the usual number of birds' nests in the spring of 1855; others attributed the abundance of the *Lepidoptera nocturna* gener-

[2] His nephews. [3] The entomologist.

ally to the scarcity of birds killed by severe winters. Curtis said this could scarcely explain the case of the Noctua tribe, since they get through their first change the autumn or summer before they come out in wing. The result was that many rare moths were common and many new ones were taken. I suppose the 'Entomologists' Annual' will give you some report of this.

I had some good geological walks with Charles Bunbury, most of them dry enough, although on the immediate borders of that fenny region which Macaulay describes early in his third volume 'as saturated with all the moisture of fourteen counties.' Macaulay's is certainly a work to read slowly, and to buy, not borrow. It is full of all kinds of interest, and even the criticisms one hears on all sides show how much it occupies the public mind. I hear that his health is worse than ever. He has a bad cough, and few expect we shall ever see two more volumes. How often he must have waded through a shelf of MS. to be able to say in a single sentence that there is no evidence in such and such memoirs of certain popular stories. Some single chapters imply the perusal of a room full of books and records.

Prescott's 'Philip II.' is very interesting. Not a few readers complain that there is a want of expression of virtuous indignation on the part of the historian at the crimes of Philip II. But he makes him out to be a villain of the deepest dye, and all from his own royal letters. In regard to the *auto-da-fés*, or murders perpetrated against heretics, I think Prescott naturally makes great allowance, as in those times every well brought up young lady in Spain who was not a dissenter, would have sat and seen a Protestant burnt alive with no small satisfaction, and when the Inquisition were torturing thousands to death, with the sympathy of all or nine-tenths of the Spaniards on the same side, one must not judge the monarch as severely as we should Isabella II. if she should try now to imitate her Most Catholic ancestor.

With my love to all, beiieve me your affectionate brother,

CHARLES LYELL.

To Dr. Fleming.

53 Harley Street, London: February 6, 1

My dear Dr. Fleming,—Lord Wrottesley, at the instance, I presume, of the Committee of the British Association, left out two or three passages, in which in a tone complimentary to members of the ecclesiastical profession who are in earnest as churchmen, I had explained my reasons for objecting to ecclesiastics holding chairs of Natural History, &c. You know my reasons because they are in print, and will, I hope, refer any objector to my chapter on 'Oxford and University Reform' in my first 'American Travels.' You will also point out as a verification of my arguments founded on past experience, three remarkable illustrations of the soundness of my objection to the clergy, especially if they be eminent; that Buckland, from the time he was preferred to a Deanery, held and neglected his Geology Chair at Oxford; that Sedgwick did the same at Cambridge, or was less efficient when resident Canon at Norwich; and worst of all, that Henslow, whose influence when resident in the University was so great over the young men, no sooner became the conscientious pastor of an ignorant Suffolk flock, than three-fourths of his usefulness as Professor of Botany was at an end, and still he retains his chair! Say that I was in some degree a prophet rather than a bigot. I hope I am not to infer that the Natural History Chair is inefficiently filled in Auld Reekie. I never saw the Professor, and God knows gave him no help.

Believe me ever most truly yours,

Charles Lyell.

To Charles Bunbury, Esq.

53 Harley Street, London: February 19, 1856.

My dear Bunbury,—I was very glad to hear an account of the *Hypnum fluitans.*

Hartung has written to Professor Heer to invite him to send his S. Jorge fossil plants to me, that I may submit them to your inspection. I have made acquaintance with Mr. Wollaston, the nephew and representative of Dr. Wollaston, who has spent several years in the Madeiras, camping

out on the Deserta and in Porto Santo and on all manner of so-called inaccessible heights in Madeira, pitching his tent on the summit of Pico Ruivo among other spots.

I have learned much conchologically and entomologically from him. The beetles are wonderful in their distribution, each island and almost every rock having its own. So many peculiar to the Madeiras, several hundred, and apterous although of genera not wingless in Europe or elsewhere, &c. Query, was it not foreseen that wings would only cause them to be blown out to sea and drowned? The winged kinds may date back to the period of the old Atlantis.

The shells common to the Madeiras and southern Europe, about a dozen of them, can be almost all proved to have been introduced by man, and the date of their radiation from Funchal is often known. A *Lymnea truncatella* got in thirty years ago, and has gone all over the island. A friend of Wollaston received a flower from Europe in a pot very lately, and found five species of European helices alive, buried in the mould. But although the fossil species of Madeira and Porto Santo are seventy-five in number, not one of them belong to any of these modern immigrants, and in the whole seventy-five, only one British, *Helix lapicida*, is a species living out of Madeira.

The evidence of a connection between the Atlantic group of islands is not strong unless it was at a very remote and almost Miocene epoch. But Wollaston thinks the insects can hardly be explained without it, though there was no union with Africa. He thinks there must have been a land of passage to enable some Canary Island species to travel northwards to the Salvage and Madeiras, that the migration was from south to north.

I hope when you are next in town to make you known to Wollaston. He is of independent fortune and no profession, has published on the Coleoptera of Madeira a splendid 4to, which Hooker and I have got the Athenæum to purchase, and you will do well to read the introductory remarks.

Ever affectionately yours,

CHARLES LYELL.

To Professor Oswald Heer.

53 Harley Street, London : April 23, 1856.

My dear Sir,—I received a few days ago both copies of your most valuable essay on the 'Plants of S. Jorge,' and am very much obliged to you for them. I sent off one to Mr. Bunbury, who is reading it with great interest, but slowly, as he does not read German as fluently as many other modern languages. I will, however, take the liberty of observing, that your style is so clear, and the sentences of such moderate length, that it convinces me that what we complain of in regard to the involved sentences in most German authors, is not the fault of the language, but of the writers.

Mr. Bunbury sees by the figures you have given that four of your ferns are wanting in our collection, namely: *Trichomanes radicans, Osmunda regalis, Asplenium Bunburianum*, and *A. Marinum*.

On the other hand we have three very well-marked ferns, and perhaps a fourth, which you have not.

One of the most remarkable of our dicotyledonous leaves is not in your set. Mr. Bunbury agrees in the identification of *Pteris aquilina* and *Oreodaphne fœtens*.

I am extremely pleased with your discussion of the old 'Atlantis,' a subject on which I have been preparing some observations, especially in regard to the fossil and recent shells. MM. Lowe and Wollaston have of late been seven months under tents in Madeira, Porto Santo. They have satisfied themselves that *Helix pisana* is not truly fossil, but lies bleached and dead on the top of the Caniçal and Porto Santo shell deposit. They believe it came into the island with man. Indeed they admit no European shell to be truly fossil except *Helix lapicida* in Porto Santo, now lost in the Madeiras as a living species.

They have found *Helix tiarella* living in the north of Madeira. But these and other discoveries do not alter the data on which you have reasoned materially.

I have told Wollaston of your Laparocerus. I am in hopes that Mr. Bunbury will still find some novelties to communicate in the way of species, though he and Dr. Hooker are

very timid in identifying species in comparison with yourself. The specimens of the fossil *Myrica Faya* which you have figured do not agree closely with any of the varieties of the same plant which Mr. Bunbury brought from Madeira and Teneriffe.

We have more numerous and finer specimens of *Woodwardia* than yours, and hope you will remember that Mr. Bunbury recognised this plant in my paper in 1854 to which you refer. He thinks it is *W. radicans*, as he allowed me to say at that time.

When I asked Mr. Wollaston why there have been no coprophagous or dung-eating beetles created in Madeira, he answered because such already existed in the island, and they are now playing their part. I asked, 'What did they feed on before the era of man?' and he said, 'Probably on decayed wood.' Believe me, my dear sir,

Most truly yours,

CHARLES LYELL.

To C. J. F. BUNBURY, ESQ.

53 Harley Street, London: April 30, 1856.

My dear Bunbury,—I rather think that Heer stayed later in the year than we did in Madeira. Wollaston says that a botanist had almost better never go to Funchal at all, where the nine years' fire burnt all the native flora, and left a clear field for the foreign invaders. He speaks with rapture of getting into the interior and camping out, at the height of 4,000 feet and upwards, on the Fanal and other native woods.

After what he tells me, I feel how fortunate I was in regard to geology, for certainly Funchal is a first-rate station for that science.

I certainly believe that the Madeiras were islands in the Miocene sea, and that most of the indigenous shells came there after the separation, and the reason of the flora being so much less peculiar than the land shells is partly that the latter have comparatively small powers of migration, especially across salt water.

Are Carices among the swamp plants which have a wider

range than plants loving drier grounds? I have got some of their seeds (Carex) from Dr. Boott, and am making experiments as to their power of vegetating after long submergence in salt water. The seeds of Carices I find float well in salt water, and a marine current would carry them far in a short time. Many seeds will not float at all. Allowing, what you say is admitted by botanists, that the temperature of pools of water is more uniform than that of the dry land, the seed of a Carex thrown ashore and getting into a fresh-water swamp behind a line of sea-beach, or cast on a delta, would be likely to thrive, while other dry-land plants would not find a fitting climate.

According to Maury's last chart of the Atlantic, and his deep-sea soundings, I think the only way Madeira could be united with Europe and the Azores is by land stretching round and crossing the Atlantic north of the latitude of the Azores, and then coming south again.

What you say of the difficulty of supposing a connection with America is a good hint. Wollaston rather exclaimed against it as new and doubtful, entomologically speaking. Agassiz always maintained that the European flora was like that of the United States. If so (*Smilax*, *Comptonia*, and other genera were cited in common) some Miocene forms coming down to our times might create a generic resemblance between the Madeira and American floras.

The *Ancylus fluviatilis* is said to have been indigenous in the Madeira rivers, and lately the Portuguese introduced unintentionally the *Lymnea truncatella*, and it has run over the island in thirty years, and is said to have appeared even in pools and ruts in the roads. If this be so, they have powers of spreading which require investigation. I suspect that their spawn adheres to water-birds and water-insects?

When Huxley, Hooker, and Wollaston were at Darwin's last week, they (all four of them) ran a tilt against species farther I believe than they are deliberately prepared to go. Wollaston least unorthodox. I cannot easily see how they can go so far, and not embrace the whole Lamarckian doctrine. Huxley held forth in a lecture last week about the oxlip, which he says is unknown on the Continent. If we had met with it in Madeira and nowhere else, or the

cowslip, should we not have voted them true species? Darwin finds, among his fifteen varieties of the common pigeon, three good genera and about fifteen good species according to the received mode of species and genus-making of the best ornithologists, and the bony skeleton varying with the rest!

After all, did we not come from an Ourang, seeing that man is of the Old World, and not from the American type of anthropomorphous mammalia? Pray write soon.

Ever affectionately yours,

CHARLES LYELL.

P.S.—M. de la Harpe of Lausanne called here one morning, and when I expressed my misgivings as to Heer's confidence about species founded on mere fossil leaves and fragments of leaves, he said that I ought to see Heer's collection and mode of work, and I should have more faith. I told him that Wollaston could not have felt secure without a leg or one of the antennæ of the beetle, not even that it was of the division of the Curculionidæ to which Laparocerus belongs, much less as to its not agreeing with any of the numerous known species of Laparocerus, a genus peculiar to Madeira.

De la Harpe replied, 'I am not at all surprised. Mr. Heer once, from a fragment of an insect's wing from Œninghen, said what it was, and the whole insect has since turned up fossil, and is exactly as Heer drew it prophetically. No one,' he continues, 'who does not make a study of elytra or wings as a separate branch, or of the leaves of plants, can imagine the resources of that branch when isolated, and when the entomologist or botanist feels he must rely on that and that only.'

All this convinced me at least that Heer is a man of genius, who impresses those who come into personal contact with him with a complete faith in his powers.

De la Harpe himself has converted Salter into a far greater belief in 'foliology' than he had before, and I saw the table in Jermyn Street covered with the leaves of numerous species of figs (Ficus) to prove that many of the Isle of Wight Eocene leaves are true figs by their venation. C. L.

To Dr. Joseph Hooker.

Hamburgh: July 25, 1856.

My dear Hooker,—A few minutes after you left me on Sunday, I fell in with the two copies of your Essay,[4] and have had one as my companion for two days, during a calm voyage to this place. I had read it before, but now I have digested it, and so the spirit moves me to thank you for it. Had I published when I returned from New Brunswick an Essay introductory to the Geology of that British colony, I should not have sold more than half a dozen copies. But had you gone to a publisher who knew his business, and who would have suggested or insisted on some general title, as 'On Botanical Classification, with Considerations on the Limit of Species in the Vegetable Kingdom' (and then in small type, 'In Special Reference to the Flora of New Zealand'), 'being an Introduction,' &c., you would then have sold a great many for the benefit of science, yourself, and all of us, zoologists included. Some day or other I would have you get out the whole of it almost verbatim, with selections from 'Flora Indica,' to serve as canons in natural history. This kind of work will be very indispensable from some one of authority, seeing where we are drifting to; for whether Darwin persuades you and me to renounce our faith in species (when geological epochs are considered) or not, I foresee that many will go over to the indefinite modifiability doctrine.

If so, it will not, or ought not, to make the slightest difference in regard to the rules you lay down, and in doing which you have with prophetic caution anticipated the possibility of many of your readers embracing the transmutation theory. But the species-multipliers will be delighted with a theory which sanctions to a great extent the conclusion that the boundaries of species are in the nature of things artificial, or mere human inventions, and therefore gives them a kind of right to affix their own arbitrary bounds. So long as they feared that a species might turn out to be a separate and independent creation, they might feel checked;

[4] Introductory Essay to the *Flora Antarctica*.

but once abandon this article of faith, and every man becomes his own infallible Pope. In truth it is quite immaterial to you or me which creed proves true, for it is like the astronomical question still controverted, whether our sun and our whole system is on its way towards the constellation Hercules. If so, the place of all the stars and the form of many a constellation, will millions of ages hence be altered, but it is certain that we may ignore the movement *now*, and yet astronomy remains still a mathematically exact science for many a thousand year.

You must go into the doctrine laid down at p. 13 with fuller explanations, and it must come to be understood that they who make species must be consistent with themselves, and make them all of co-ordinate value. If they will not admit your two cedars to be one species, they must then deny the authority of Linnæus and other great naturalists who have made the primrose and cowslip one and the same. I cite this at random, but some such inconsistency should be exposed, and they should be set down as totally wanting in philosophical power and their synonyms never cited. I could furnish good examples in conchology of such utter neglect of relative value in the species invented by the ignorant, who at the same time adopt the names of their predecessors, which comprehend a much wider range of varieties in one species of the same genus.

The speculations as to the quondam connection of the antarctic lands now separated by ocean are very interesting. I think Darwin does not enough allow for a suggestion which you advance, that the land from which species now common to A and C migrated, may have been in the space



B now occupied by the ocean. I always incline to the idea that existing continental areas are in great part of post-eocene date, as Europe, north of Africa, and a large part of Asia best known, certainly are. For similar reasons spaces like B may have been the compensating areas of subsidence.

Your idea of the antarctic species going north by the Andes, and of the Panama Andes having once been loftier, is

very grand and probable. The marine (living) shells each side of the narrow isthmus of Panama are very distinct, and it is most probable that in the older Pliocene period that isthmus was higher and broader.

Your occasional criticisms of Edward Forbes, to whom you have done ample justice, interested me much, and some day I should like to talk them over, as well as a multitude of other topics. I expected you would have used ice-rafts more freely in the antarctic; coupling them with oscillations of level in the post-miocene ages, one might get a most complicated succession of states of the same area, geographical and glacial.

I fear much that if Darwin argues that species are phantoms, he will also have to admit that single centres of dispersion are phantoms also, and that would deprive me of much of the value which I ascribe to the present provinces of animals and plants, as illustrating modern and tertiary changes in physical geography.

I am also wholly at a loss to account for such facts as you told me, of the *Lysimachia vulgaris* in the Australian Alps, if we embrace the indefinite variability speculation, doing away with all creation, and substituting a power of individuals to produce offspring unlike themselves, or a posterity referable to distinct species. For if such were the influence of external causes, one would think that the *Lysimachia*, or *Capsella bursa-pastoris*, could not retain its character after wandering over the globe, and that it would be contrary to the doctrine of chances that the individuals descending from common parents of a different species should be found in the southern and northern hemispheres with identical characters, each having of necessity got into this new state or permanent variety (or species) by quite a different set of changes, both as to climate and co-existing animals and plants.

If such results were possible, I should expect the recurrence of the same species in distinct geological periods, after they had become extinct, or in abeyance for an intermediate period or two. I have seen the Zamias and Cycads of the Botanic Garden here, but have not yet seen Lehman; however Otto, the inspector, showed Victoria Regia in

flower, and all sorts of Nymphæas, which are killed, root and all, every winter, and yet are got up in seven weeks in great beauty.

I am just starting to see Wiebel, the geologist.

Believe me ever sincerely yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Warmbrunn, at foot of Schneekoppe, Riesengebirge: August 8, 1856.

My dear Horner,—We have just been taking a walk in a fine evening's sunshine, to see the warm springs and the scenery of this beautiful watering-place; the top of the Schneekoppe, 4,954 feet high, quite clear, but the Schneegrube, only 300 feet lower, capped with clouds and looking grander for the moment and loftier than its conical neighbour. We came here to-day from Breslau, thirty-five miles by rail, and about thirty more by extra post, over a good road, and through a very fertile and thriving country. The railway took us through a brown coal country, partly covered by Scandinavian drift.

When we left the plain, about 600 feet high, and got about 1,000 feet above the sea, we were in carboniferous and trap rocks chiefly, and now in granitic. Ferdinand Roemer and Goeppert were very attentive during our stay at Breslau. We had not seen Roemer since he came to us in Hart Street ten years ago, before he went to Texas; he has seen much, and is well read in geology. Goeppert showed me his coal plants, and tried to persuade me that his Stigmariæ were not roots, but a perfect plant of some aquatic species. His specimens in amber are very curious, and worth seeing, and especially under the microscope. Some large ones having the whole surface filled with circular convex indentations explain the specimens of copal which you may have seen on my mantelpiece in London, and which puzzled Charles Bunbury, and if I remember right, Robert Brown. The amber which has these markings is always found buried in the earth, and with a coating of decomposed amber, which comes off; and Goeppert says that much copal is dug up out of the soil at the foot of trees, &c., which produce it. He

has a process by which he can give this kind of surface to amber.

August 9.—Yesterday Mary and I reached the highest summit of the Riesengebirge, an expedition well worth making from Warmbrunn. The latter place is about, I presume, 1,000 feet high, but I missed my barometer much, after my Madeira experience, having got accustomed to read off at once from the instrument, without calculation, an approximate height. The first seven miles was over a level region, where the granite peeps up in small knolls, and where there are numerous ponds, with oak, lime, birch, and fir. This region contrasts well with the fir-clad hilly region, where we left the carriage and began the ascent, I on horseback, and Mary carried on a chair by two bearers. We had seven miles to go to the top of the Schneekoppe; first a mile through a straggling village, Seydorf, with orchards and gardens, then into a wild country of spruce fir, with very vigorous undergrowth of the whortleberry, which only allows the heath, *Calluna vulgaris*, to grow here and there in patches. At every two or three miles, a small farmhouse, fitted up as an inn, serves as a resting-place, and as we had occasional showers, enabled us to dry our cloaks and umbrellas and to take refreshment while the men smoked, &c. After passing some clear trout streams gushing down their granite channels, we climbed at last to the region of Knieholtz, or brushwood, where the spruce firs which had exclusively formed the woods below become stunted, only three or four feet high, and nearly all the ground is occupied with a short fir, looking like dwarf Scotch fir, but I have gathered same branches with cones to ascertain. I believe in the guidebooks it is named *Pinus pumilis*. Here a species of *Persicaria* in flower almost equalled the dwarf pines in height. Iceland moss, gathered here for lung complaints, was very abundant. The snow prevents any tree from getting up above two or three feet, but there were no 'stag's horns' or bare boughs such as I saw on the 'White Mountains'—in the same zone of stunted trees. We then came to the bare region where there are no trees, and much rock covered with *Lichen geographicus*, and at the top some 300 or 400 feet, where the slope of the granite is inclined at an angle of 35°;

but a zigzag road enabled us to ascend without difficulty. I was disappointed at not finding the vegetation at the summit more alpine. The same *Persicaria* we had seen far below was still conspicuous, a species of *Hieracium*, a few plants of heath (*Calluna*), a *Luzula* very abundant; these and a few others we have preserved, and a red lichen which looked like paint on the rocks, or the colour of the French soldiers' trousers, and a black lichen, with many others; but so many of the plants looked like those far below, that I wondered that 5,000 feet, even in the latitude of London, did not seem so arctic as the Clova hills, or hardly as the Clune, near Kinnordy. A traveller showed me the common Monkshood, and said he gathered it near the top; we could not see it, but it was conspicuous below in the woody region. Patches of snow had remained only eight days before we were on the summit.

After having been so many days between Hamburgh, Berlin, and Breslau, in the great plain of Scandinavian gravel, it seemed quite strange, as it will do to you in the Hartz, to be in a region of purely local drift. Nothing but the wreck of true Riesengebirge granite and gneiss, which comes up to meet the granite on the south side of the highest ridge near the top, not one far-drifted pebble.

For part of the day, the granite cone of the Schneeberg had a banner of vapour streaming from it like Etna, when the rest of the range was free from it. Joseph Hooker describes this as very singular in reference to the isolated and loftiest peaks of the Himalaya, and tries to explain it meteorologically.

In the stunted fir-region, a dandelion-looking flower, which we have kept, was pointed out by our guides as 'Arnica.'

At Breslau (the easternmost point I have ever reached in my travels) Goeppert showed us his splendid brown coal tree, formerly called *Pinus proto-laryx*, 26 feet in circumference, but another 33 feet has since been found. The state of preservation of the wood, which divides like deal in a peat bog, is to me very strange; for no matter whether the formation be called the lowest 'oligocene,' according to Beyrich's nomenclature, or by any other term, it is certainly about the

age of the Isle of Wight series, below the Hampstead beds, about the top of my Middle Eocene.

I must send this off, trusting to Mary to say how pleasant a time we passed at Berlin, and to tell unscientific news. Humboldt was very courteous. It was a great pleasure to hear all were well. Mary came down quite fresh from the mountain, but as I had not been on horseback for an age, ten hours' riding with only two off the saddle, made me tired, till a good ten hours of bed restored me.

Ever affectionately yours, CHARLES LYELL.

To LEONARD HORNER, ESQ.

Prague: August 23, 1856.

My dear Horner,—Geinitz showed me much at Dresden. Not many miles from that city, to the north-west, there is a region where numerous deep coal shafts are sunk 1,200 feet deep, through chalk and Permian into coal, so that they are turning the country into a manufacturing region, and getting it covered with railways, and threatening to make the capital so smoky that the Madonna di San Sisto and the other wonders of art may ere long run the same risk as the contents of our National Gallery.

Geology has gained much by these speculations to win the coal at such depths. They go through chalk marl, under which is the lower Quader, a sandstone representing our upper greensand, and sometimes greenish. The roth-liegendes beneath this is of various thickness, associated with porphyries and syenites, which come in in unexpected places, and interfere with speculation and contracts. The coal is often excellent. The specimens of rothliegendes conglomerate showed that brecciated character which made Ramsay conclude a glacial origin for some of ours, but these Saxon cases would not help him much, as the angles are often worn off. Yet as contrasted with Old Red and New Red, the subangular character of the fragments in these Permian agglomerations holds good, and is very singular.

Our exploration of Saxon Switzerland with Gutbier as a guide was thorough. The scenery of that beautiful region derives its chief beauty and peculiarity from the upper

Quader, a mass of quartzose grit, like some millstone grit when coarse, and when fine just like much of our tertiary 'Druid Sandstone,' being often 800 feet thick, and rent in two opposite directions, and the joints often open, and these joints facing the rivers, and brooks, and valleys quite perpendicularly, with here and there intervals of two, four, or eight feet between two joints removed, you have ravines and separate columns innumerable. As this mass is above the level of the Pläner, which is lower white chalk, or grey chalk (the clunch clay of Strata Smith), it follows that it represents our white chalk. In other words the Quader of Saxony, a grit wholly deficient in calcareous matter, corresponds to the most purely calcareous rock of Great Britain, and yet contains here and there the same shells.

I was glad we made an excursion to the country on the left bank on the south-west side of the Elbe in Saxon Switzerland, for there I saw the same Quader unbroken, and forming large platforms, instead of such isolated masses as at Königstein, Lilienstein, and others which occur chiefly on the north-east side, though by the way, Königstein is an exception on account of the winding of the river. From the Schneeberg, 2,300 feet high, where the cretaceous or Quader reaches its highest point, we had a fine view into Bohemia, the Toeplitz region, and of the Mittelgebirge, where the Milleschauer, a phonolitic mountain, very conical, is 2,500 feet high, and in another direction saw the beginning of the Erzgebirge. Returning to the Elbe at Tetschen, Gutbier resumed the railway to return to his fortress of Königstein, of which he is sous-commandant; a great place, which the late King of Saxony, a lover of science, gave him, because he was a naturalist as well as a good soldier and military engineer, though not in the engineer corps. He regretted missing Charles Bunbury when he was at Dresden, as he had published on the fossil plants of the Saxon Permians. We learnt the names of many wild plants while with him, but mostly English ones or Scotch. I don't know whether *Prenanthes purpurea*, which was new to me, is British. The extreme scarcity of land shells, owing doubtless to the absence of calcareous matter in the Quader, is quite striking. Yet on the walls of the fortress of Königstein, where arti-

ficially lime had come with the mortar, we found two *clausilias* and a very singular planorbiform variety of *Helix lapicida*, which may throw light on one of my Madeira fossils.

My excursion to Toeplitz and Bilin gave me a good idea of the chalk, and brown coal, and basalt, and syenite, and the infusoria beds of Bilin.

The number of shafts sunk into the tertiary to obtain brown coal is so great between Toeplitz and Aussig, and the tall chimneys so numerous to pump the water out of the mines, that you would suppose yourself in an old coal country. Yet it is only Upper Eocene.

The gorge through which the Elbe flows south of Aussig displays fine sections of this brown coal in the form of sandstone with much basalt, and afterwards cretaceous beds, Pläner and Quader. We then got into the valley of the Moldau through the old coal and overlying cretaceous, till near Prague we entered Barrande's Silurian of Bohemia, and here I found this great workman and discoverer himself, very much disposed to show me the principal localities of the 1500 ! ! species of Silurian and Cambrian fossils which he has brought to light, nine-tenths of them distinct from the *species* of Scandinavia and England. Sternberg had only worked in the old coal.

How little did I think when La Place once pointed out to me, from the top of the Observatory at Paris, the number of new convents rising on all sides, and new Jesuit establishments, and expressed his indignation at it, that among other results of this bigoted course which Charles X. was then pursuing, would be the banishment of the Bourbons, first to Edinburgh and then to Prague, where, twenty-four years ago, Barrande, the tutor of the Duc de Bordeaux, began geologising ! He took me to the quarry where he found the first orthoceras, and where we picked up many. He went with it to the Museum at Prague, where they assured him that Count Sternberg had left nothing for anyone to do in this region. Barrande has now 500 species of Cephalopoda from these beds, proving among other things, as he quite admits, that the mollusca, at any rate, were high enough in the scale in those very early days, and the very class of whose history from first

to last we know the most. I have been in two immense quarries, one in limestone and another in trap alternating with Silurian schist, exclusively worked by Barrande for fossils, and there are others of the same kind in all directions. A perfect knowledge of the Bohemian language was indispensable for Barrande, and I have heard him talk with the peasants most fluently. For twenty-four years he has gone on steadily investigating this region, which is twenty-four French leagues in its longest diameter. I mean the fossiliferous part of the old rocks. It is very difficult to remember Barrande's nomenclature, as he only uses letters. I have already been twice on the ground of this famous *colony*, as he terms it, and, explain it as we may, it is the most singular and, at first sight at least, anomalous fact I ever remember to have verified in paleontological geology.

As he puts it in his work, it is a sort of anachronism, not by any means equalling the Petit Cœur case of supposed coal plants of the Alps occurring in lias, but a small approach to the same kind of entanglement of two distinct faunas or assemblages of species, which but for these few exceptional localities would have been supposed to have had nothing whatever to do with each other, or to have belonged to two distinct (though consecutive) epochs.

Yours affectionately, CHARLES LYELL.

To HIS SISTER.

Vienna: August 28, 1856.

My dearest Caroline,—I found your letter among many others in the Post Office, and was much interested with the entomological news. I had quite made up my mind that Wollaston would be very glad of the contents of the box, for knowing you have a good eye for insects generally, and a practised one for *Elaphrus lapponicus*, your remark to me that the batch was undersized struck me much, and I thought the Wilsons had gone up to some higher bog and got a smaller variety of *E. lapponicus*, which would, I suspect, have been more curious in Wollaston's eyes than this *E. uliginosus*. I have told my bookseller to send you a copy of Wollaston's book on the variation of species as illustrated by insects, that you may see how he is at work. I have had no time to

look even after *Lepidoptera diurna* on this tour, but have been struck with their perfect identity, such as came in my way, with those of England. At Dresden I saw the 'Camberwell Beauty'—I forget the Linnæan name—but at any rate the English name is, if I mistake not, much older than Linnæus,—a splendid insect on the wing. Although I have missed Professor Reuss, the geologist of Prague, who was travelling in Moravia, I have been very lucky in finding the men I wanted at most of the principal places I have visited. The Prussians have a University (equal in the number of students to Bonn, though not equal to Berlin) at Breslau, the capital of Silesia. Herr Goeppert and F. Roemer, who have published good works on geology, were very attentive. At Dresden Professor Geinitz, whom I missed when last there, accompanied me on an excursion. But I was particularly fortunate at Prague to find Barrande, a Frenchman whom I had before known at Paris and London, who was tutor to the Duc de Bordeaux formerly, and is now chief manager of his estates. When Charles X. went into exile to Prague in 1832, Barrande settled there, and finding the Germans were neglecting the older (Silurian and Cambrian) rocks, and that they were rich in fossils, he set to work, and spent all his own private fortune in opening and working quarries expressly for the fossils. How many thousand pounds sterling he expended in twenty-four years I cannot say; but he told me that in order to explain the eighteen metamorphoses of a trilobite called *Sao hirsuta*, he collected 20,000 specimens, and they cost 5,000 francs, or 200*l*. He has at length got 1,500 species, and nearly all of them are peculiar to Bohemia, or new. He showed me these in his museum, some of which, however, I had seen at Paris, and I went four days on an excursion to understand the quarries and position of the beds, and some very extraordinary results at which he has arrived. He is a very remarkable man, with a good deal of simplicity of character, so rare among Frenchmen, and much commoner in Germany. Our friend Colonel Gutbier, with whom we spent three agreeable days in Saxon Switzerland, complained that Humboldt had lost this simplicity by living so much in Paris. I found him, however, at eighty-seven, just what I knew him more than thirty years ago, quite up to

all that is going on in many departments. Think of his eyes, when in these days of cheap postage, his letters cost him 100*l.* a year, and he answers and reads himself nearly all!

Ever your affectionate brother,

CHARLES LYELL.

To DR. FLEMING.

Vienna: August 31, 1856.

My dear Dr. Fleming,—I was very glad to receive your letter at Pragne. I have been much pleased with what I have seen of those parts of Saxon Switzerland, as it is commonly called, which I had not explored when there some years before. At Prague I made four excursions with M. Barrande, who has perhaps done more work than anyone in our time in paleontology and the field united. He explained to me on the spot his remarkable discovery of a 'colony' of Upper Silurian fossils 3,400 feet deep, in the midst of the Lower Silurian group. This has made a great noise, but I think I can explain away the supposed anomaly by adopting Barrande's printed explanation about the removal of a barrier, and by allowing for ten per cent. of 'peculiar' species in the so-called colony—a point, I believe, often overlooked. But I will not go on, lest you should not have read about this famous puzzle. What between Sweden and Bohemia we have now 120 species of the Cambrian (or Primordial) fauna all distinct, and all the *genera* of the trilobites save one, from the Silurian. As Barrande names his primordial fauna C, it is easy to remember that this stands for Cambrian. In all, he has 500 species of Cephalopoda, scarce one of them English or Swedish. They show that the mollusca in early days were not of simple form, but of high degree. About 130 gasteropods, but not one of Lamarck's canaliculata, so I suppose the carnivorous cephalopods did their work, as Dillwyn used to say, long ago.

The Silurian fauna of the United States agrees considerably with that of England and Sweden, which may have formed one great province becoming gradually different in its remote parts, while Bohemia, Spain, and Portugal constituted a second province, having all the species except a few brachiopods distinct. Besides these, there must have

existed contemporaneously another province, namely, the mother-country of the famous 'colony.' All the facts stated by Barrande respecting the latter are perfectly true, as I am now convinced. Murchison has been over the ground, and, as Barrande tells me, has printed his adhesion to Barrande's view so far as the section is concerned. Fortunately the Moldau, or rather the great natural rent through which this river passes, lays open clear and continuous sections displaying most beautifully the succession *en masse* of the rocks composing the groups D, E, F, G, including the 'colony,' so that he who runs may read, provided he has Barrande with him to cross-examine. I never saw Silurian fossils in such abundance except in a few strata in Sweden; but here they pass through many thousands of feet. Yet the whole fossiliferous area is only equal to one-sixtieth part of the Adriatic. As Barrande himself has calculated this, I wonder he remains such a finality man. I remember at the Geological Society when Sedgwick and Murchison used to argue with me exactly on the grounds now taken up by Barrande in proof of a beginning of life on this globe, founded on the notion that no fossils would ever be found below the stiper stones. Now that a totally distinct fauna has turned up, and that the transformations of some are traced from the egg to the adult, the discoverer is just as sure that here at least we have the true beginning. We expect to be home about the end of October.

Believe me ever truly yours,

CHARLES LYELL.

CHAPTER XXIX.

SEPTEMBER 1856–AUGUST 1857.

GEOLOGY OF THE NEIGHBOURHOOD OF VIENNA—STYRIA—SALZBURG—DISCUSSION WITH HEER AT ZURICH—FOSSILIFEROUS QUARRY AT SWANAGE—VISIT TO SWITZERLAND—FOSSIL PLANTS—ELIE DE BEAUMONT'S FRANK OPPOSITION.

CORRESPONDENCE.

To LEONARD HORNER, ESQ.

Middendorf, Styria: September 15, 1856.

My dear Horner,—We are here in a small inn in the Styrian Alps some 2,500 or more feet above the sea, and where they have six months of snow from December to May. On our way from Gratz to Ischl, it is a beautiful country, of green meadows in the foreground, and cultivated fields on steep slopes, with usually a background of limestone mountains, with perpendicular precipitous sides often of bare rock, but with larch and spruce on every available ledge.

I left off at Vienna with my geological news. Before quitting it I contrived to make excursions with different geologists to the chief points of interest both in the Miocene tertiary basin, where the beds are nearly horizontal, and the secondary and Eocene tertiary rocks, where the strata are at high angles or vertical, as usual in the Alps, of which we have here the eastern extremity, although they are in fact continued in the Carpathians, with the same strike and character. The commencement of these last mountains is well seen from some of the heights near the northern suburbs of Vienna, one of which called the Himmel, near Sievering, I visited in company with Mr. Cevarowitch, one of the officers of the Government Geological Survey. In that hill are splendid quarries of highly inclined Vienna sand-

stone, corresponding to much of the Alpnie Flysch, and deserving the name of Azoic as much as certain rocks so called in Scandinavia, in which fucoids have been found, as they have been in this Viennese sandstone. I could not help looking on it with great interest, even from its negative characteristic of containing no fossils, whether in the Viennese or Swiss Alps. There seems little doubt that part of it is of Jurassic and part of Eocene origin, for some few nummulites have been lately detected in one region and specimens of Aptychus in another, but they must be wonderfully rare, since so many magnificent quarries have been opened in it for building and paving stones, and the whole Viennese corps, who have proved themselves very sharp-sighted collectors, pronounce the formation to be hopelessly barren. I wrote to Barrande to commend to him these 'Azoic' beds, as he argued with me at Prague that no living beings could have inhabited the globe before his 'primordial fauna,' because some of the sandstones below his primordial were precisely like in mineral character to others lying above it, and in which fossils have been met with. Edward Forbes used to say that no one who has dredged much can ever wonder at rocks being wholly devoid of organic remains.

I was fortunate, just as I was on the wing for Styria, to see a young geologist who has been kept always at field work in the Alps by their Survey, of the name of Stur, very much in earnest, as indeed they all are, but who is by far the most ardent generaliser of them all. He knows no language but German, but Studer arrived in time to help me in one of my conversations with him. Stur is, I believe, the first who has attempted to give a series of diagrams showing the state of the Alps from the earliest periods. He makes out eight or nine periods of elevation, or of convulsion rather, or movement.

Upon the whole the quantity of work done and doing in Austria, and the number of young rising men of education and some of them of family, interested in geology, is very striking, and as they are all connected with mining establishments, and therefore professionally occupied, or with Imperial Museums, they will continue to pursue the science. It is a great pleasure when one stops at a coal-mine, as I did at Leoben, a small place between this and Bruck in

the Styrian Alps, to find several gentlemen of education managing the works. It was a tertiary coal, forming a bed of coaly lignite actually some forty feet thick, of Miocene age, with fossil plants. There are many basin-shaped masses of such lignite formations in the Styrian Alps, in some of which freshwater shells (a few of them of living species) accompanied by *Mastodon angustidens*, *Anthracotherium*, &c. occur, a good deal disturbed and yet horizontal as compared to the distorted, coiled, and overturned older stratified masses of this wonderful chain.

Boué made himself very agreeable and useful to me in two excursions. He told me that at one time, having a fright about French political affairs, and expecting that Thiers would make war with England, he sold all his money out of the French funds, and having a great opinion of the United States, bought into theirs, just when they happened to be most depressed at the time of the panic after the 'repudiation' affair. In a few years he found his fortune exactly doubled by the rise of the United States state and other securities, upon which he sold out and invested in land and houses in Austria, to which his wife belonged. Here he felt rich for many years, and has still a house in Vienna, and a delightful country house near Baden, an hour and a half by railway from Vienna, the environs of which city are most agreeable and picturesque and geologically varied, as you would expect on the flanks of the Alps, or where they join the tertiary of the plains. But the increase of prices and enormous pressure of taxation has of late made Boué feel poor, and unable to travel and geologise as he would wish.

Hallstadt: *September* 20.—It is raining here, and the snow has actually fallen last night on the higher part of the hills not more than 4,000 or 5,000 feet above the sea, which rise abruptly 2,000 or 3,000 feet from this beautiful lake which is under our windows, separated from us only by a garden full of Dahlias and China asters. We made out our expedition to the valley of Gosau very successfully yesterday, and saw enough, though the clouds came down too fast, to convince us that it has not been overpraised by lovers of scenery. The fossils of the chalk, consisting chiefly of univalves, might well lead a geologist not familiar with the

Blackdown beds, to imagine that the formation was tertiary, although the species are different, and the hippurites and other cretaceous forms ought soon to rectify the idea.

I have fortunately obtained here from the Bergmeister two specimens of moderate size of the Hallstadt (upper triassic) limestone in which an ammonite is associated with an orthoceras in the very same fragment. They say that Von Buch came here to ascertain the fact, and confessed that it overturned a favourite theory of his. I spent an agreeable day and a half with Unger, and I gave him a copy of Charles Bunbury's paper on the 'Carboniferous Plants of Cape Breton,' which he (Unger) was glad to have. In this limestone region we have been finding many land shells, especially in our excursion to the three beautiful lakes through which the Traun runs, or rather from the highest of which it rises, so justly praised by Sir Humphrey Davy.

Ischl: *September* 20, 1856.—We have just arrived here, the clouds covering the mountain-tops and leaking a little at intervals. We found letters from Berlin to Mary, and yours to me. I am glad you saw Ewald, and that he approved of my attempt to explain Barrande, who has half, but only half, given in. I accused him of a downright anachronism, which of course he did not quite like; but it was really a solecism, and he ought to thank me if I can help him out of it. No doubt Ewald is right in saying that the word 'colony' is wrong in the exact way in which Barrande uses it. But if we consider it as a colony of an antecedent state of the fauna of E, the term will do. The first European settlers in Virginia were a colony from England, though not of England when she had more than doubled her population in the days of Queen Victoria.

With love to all, ever affectionately yours,

CHARLES LYELL.

To C. J. F. BUNBURY, ESQ.

Salzburg: September 27, 1856.

My dear Bunbury,—Your letter was forwarded to me from Innspruck to this picturesque and beautiful town. There is so much to see here, and in the snowy Alps imme-

diately to the south of it, both in geology and scenery, that I have determined not to go so far as the centre of the Tyrol, as it would be too hurried a journey to do any justice to it, and the shortening of the days and the snow on mountains only 6,500 feet high, which fell last week and is very slowly melting, has warned me that the best season has gone by. Yet we have had to-day a clear blue sky, and a sun often too warm to expose ourselves in, without shelter, and the tops of the Great and Little Watzmann as steep as the Aiguilles of Mont Blanc, 8,000 feet high, have formed a grand feature in our landscape in an excursion in the neighbourhood. I am trying to understand what members of the 'Alpine Limestone,' as it was formerly called, are Jurassic, which Triassic, and which Cretaceous. It is strange to think that rocks so devoid of fossils to a cursory observer, should have yielded of late, by dint of searching some particular spots and beds, such a multitude of species, 1,200 invertebrate for the Upper Trias alone.

The sandstone with *Fucoides intricatus*, a part of the 'Vienna sandstone,' seems to be made out pretty clearly to be a member of the chalk above the gault. I collected some of the fucoids yesterday, which were so fine that I shall send you specimens when I return.

Ever since we have been in the Alps, we have not ceased to admire the profusion of autumnal Gentians, consisting of three kinds, which we are told are *G. ciliata*, a fringed sky-blue one with a fringe on the corolla, *G. autumnalis* (or *Germanica*), a purplish one with many flowers on a stem, and *G. asclepioidea*, with several rich blue flowers on a long stem. The latter abounds most at higher levels than the other two. The *G. Germanica* is often as thick as some purple orchises in boggy ground in England. We observe that on the same stem, some flowers have four and some five divisions of the corolla, and a corresponding number of stamens respectively. Perhaps this is common in many other common genera. They regard *Colchicum autumnale* as a pest here. It adorns the meadows very much, and is as thick as if in a garden plot at very various elevations. This town is more than 1,309 feet high, though commanding a view of the great plain of Bavaria, and looking low with the Alps on one side.

I have been observing the land and freshwater shells with some attention. After collecting some thirty species, I have never seen that large and conspicuous English shell, *Helix aspersa*. As it is not fossil in the loess of the Rhine, I suppose Woodward may be right in saying 'that it came in with man and the dog.' *Helix arbustorum* swarms above all; *H. nemoralis* (or *hortensis*) not very common. On the whole perhaps six in twenty-five not British. I am glad you alluded to A. De Candolle's book, which he sent me, and which I have always been meaning, and still mean to read. Hooker's doubts as to the *Pinus pumilis* being the Scotch fir interested me much, for though the possibility struck me, I gave up the idea when I saw how positively it ranks as a true species in the books. Its cones seemed to me as large as those of a tall Scotch fir, which has the effect of making it look peculiar, and more unlike than its mere dwarfishness would do. It never gets so low as the (Spruce?) on the White Mountains, but I saw the *Persicaria* striving to top it as did *Lycopodium dendroides* presume to do in the case of the dwarfed American fir trees. I saw no gradual passage but the change from a region where the snow does not lie so long, to one where it endures for a great many months, is rather sudden on the Riesengeberge.

With love to Frances, ever affectionately yours,

CHARLES LYELL.

To PROFESSOR GEORGE HARTUNG.

Munich: October 5, 1856.

My dear Hartung,—I was very glad to learn by your letter which I found here, that we may look forward to the pleasure of seeing you in London on your way to Madeira. I have made progress, since I saw you, in German, having had to talk some whole days with good geologists who know no other language, so I hope to make out what you write in your own tongue, and can always get the aid of my wife when in doubt. I am well pleased that you have found in conversing with your friends, how much (and very deservedly) the connection of the history of the Madeira and Canary volcanos is dependent for one of its greatest interests on the various groups of organic remains.

To give you some idea of the difficulty of bringing all the evidence to a focus, I may mention, that when I applied at the British Museum to get the corals, Zoantharia of Porto Santo, &c., named, they told me there was no one in England who could do it, and they had just sent over their own to Paris to be named by Milne-Edwards.

So I have got my old friend the former secretary of the Geological Society, Mr. Lonsdale, our best authority, to undertake them, and his report is, I hear, ready. The Bryozoa have been examined by a competent English geologist, Mr. Busk, as a favour to me. As to the shells, I have already worked hard at them, and hope to have a list of sixty species from the Great Canary. I spent a day in comparing the two species of Cypræa with Mr. Gascoin's shells, who has the finest collection in Europe of Cypreadæ, unequalled in any public collection. The result was, that they are both new species. You remember them perhaps, and that I thought they would turn out living species, to which they have, until closely compared, a very marked resemblance.

As to the land shells, I have given much time to Wollaston's unrivalled collection, and hope to have some new and original results to work into the paper, but then the detailed lists of species, recent and fossil, which must be compared, constituting the *pièces justificatives* of what is said in the body of the paper, must be given separately.

Ever most truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Strasburg: October 22, 1856.

My dear Horner,—I believe that my last geological new was written to you from Salzburg, after which we visited most beautiful part of the Alps, immediately south c Salzburg, Berchtesgaden and the Königsee, the latter beautiful lake, surrounded by limestone precipices 4,00(feet high, and some of which look as if they were horizontally stratified, but which appearance is found after much study to be a delusion. I was greatly perplexed by it, for I knew that no single uniform calcareous deposit in the Swabian or Jura chain could boast a thickness of 1,000 feet, where

it was clearly to be made out in reference to age and relative position, and I was unwilling to believe in the sudden development and augmentation of each calcareous formation on their entering the chain of the Alps. Fortunately I fell in at Berchtesgaden with Mr. Gümbel, who has been employed for the last four years with the construction of a geological map of Bavaria by the government. He had just given several months to the very region which was puzzling me, and assured me that he had ascertained that the limestone which appeared 4,000 feet thick or more, was only 350 feet thick, and was the same member of the lias which I had elsewhere seen under the name of 'Dachstein,' so called from a snow-covered alp of that name near the valley of Gosau. He declares that the splendid cliffs of limestone bounding the lake of Königsee, and seen far beyond, forming the surface of the snow-covered 'Great and Little Watzmann Alps,' are a mere facing of stone, cleft by horizontal joints in imitation of the bedding. These alps are between 7,000 and 9,000 feet high. According to this explanation the name of Dachstein is not a bad one, for a deposit that covers or roofs such lofty mountains. I was surprised, before I fell in with Gümbel, at meeting with a species of Orthoceras in a quarry of limestone in the Untersberg mountain near Salzburg, which the Vienna geologists have set down as Dachstein. It is a quarry which has supplied marble for the Bavarian Walhalla. For I had thought it marvellous enough that I had seen several, of species of that 'paleozoic' form, in the Hallstadt or upper triassic group. But Gümbel assured me that the marble in question was even still younger than the Dachstein, being what he terms a member of the Oolite called the 'Adneter Kalk.' I afterwards learnt that very lately a *belemnite* has been detected in the Hallstadt beds, so that they are travelling downwards, while the orthoceras is ascending upwards very fast.

At Munich I called on Prof. Wagner, who very politely put off a journey he was just starting on, for a day, in order to show me over the collection of the late Count Münster, which they bought for the University of Munich. The specimens in the Solenhofen lithographic stone are splendid, as I daresay you remember. But what attracted me most was a

newly arrived set of fo sil Miocene mammalia, from a calcareous breccia near Athens, already in part described by Wagner. Not only Dinotherium, *Mastodon angustidens*, and a new large Machairodus, but a large Miocene ape, and a great creature of the sloth or megatherium family, called Macrotherium. It may perhaps be a great sloth which Cuvier determined from a single phalangeal bone in France, which I always thought a grand *tour de force*, and which some called in question.

Liebig showed us his newly built laboratory, and a friend of Gümbel's, Mr. Hessling, took me over a new Physiological Government Institution, and a separate one for Anatomy. The King seems favourable to science. In the first of the two last-mentioned buildings was an aquarium for experiments on living freshwater animals. For several years the pearl-bearing *Unios* (*U. margaritifera*) have been bred in numbers. It takes eight or ten years for a pearl to form. There are three kinds of external deformities which clearly show whether there are pearls or not inside the shell. By knowing these you may, without the labour of opening them, cast them back into the water if they are barren, as a vast majority are. It is a singular paradox which Liebig discussed with me, that the thick-shelled pearl-producing Unios live in the lakes of the granite and 'Greywacke' regions, where there is scarce a trace of lime in the water, whereas in those lakes and ponds in the limestone districts where there is a very large proportion of carbonate of lime, the Anodons with their very thin shells abound. It seems to depend on vegetable food.

At Ulm I made an excursion to see some freshwater beds about the age of the 'Mayence basin,' which, everywhere almost on the Continent, geologists call 'Lower Miocene,' and I have seen so many signs of *freshwater* and *land* species passing from strata of this age to the supposed equivalents of the Falunian, that I may perhaps have eventually to adopt this same classification, and call my 'Upper Eocene' a 'Lower Miocene.'

For if it is once established that the line cannot be drawn anywhere without being somewhat arbitrary, it may be better not to let too much be absorbed (as Hamilton

said) 'in the Eocene vortex.' My argument of the perfect distinctness of the French and English and Belgian *marine* shells of my 'Upper Eocene' and those of the Faluns still holds; but perhaps Beyrich's investigation, and Sandberger's, may eventually make out a passage even there, and Hébert thinks he has many links by aid of the Bordeaux basin.

At Tübingen I found Quenstedt, as I anticipated, a hard-working, enthusiastic, and original man. Like Barrande, he has opened large quarries in the lias and oolite exclusively for fossils, and has obtained an unrivalled series of ammonites, brachiopods, belemnites, &c., besides some fine reptiles and fish. He finds the beds admirably defined by their characteristic fossils over an area of thirty or forty miles of the Swabian Jura. He showed me the various beds in the field, and we collected the commonest species *in situ*. *Gryphea arcuata* (or *incurva*) though so abundant only extends vertically through eight feet. The number of species of ammonites, which he proves to be varieties of one, is very great.

Oppel studied for three years as Quenstedt's pupil, then travelled in France and England to compare the Keuper and Jurassic beds of Swabia with those of England and France, and out of this came the joint work of Oppel and Suess on the 'Koessen' beds, now proved to be of the age of the 'bone-bed' of Würtemburg and England.

Last year Oppel thought the bone-bed near Stuttgardt contained liassic marine shells, but they now prove to be all distinct. You may remember that for several editions back, (if not from the beginning,) I have always put the bone-bed in the trias, and not, as other English geologists did, in the lias. This opinion is now made out by the marine shells to be true. It would have been strange if the fish and reptiles had misled us.

At Zürich I was glad of an opportunity of discussing with Escher v. der Linth and Heer, both fresh from Vienna, the great question of the St. Cassian beds, or the discovery of the long sought for marine fauna of the upper trias. Also the real position of the Flysch 'Vienna sandstone;' whether, as Schafhäutt assured me, it was under the nummulitic and of cretaceous age, or, as Gümbel said, above it,

and as he almost proved to me by sections near Salzburg which I saw, or, as they told me at Vienna, partly Eocene and partly *Jurassic*! Escher is clearly of opinion that it is Eocene—an azoic Middle Eocene—perhaps 2,000 feet thick, but some think that all the Glaris fish belong to it. They showed me the celebrated skeleton of a bird in the black slate of Glaris. The rock may well pass, as it did once, for a 'transition schist.'

Bunbury will be interested to hear that Heer, who was with Escher in Italy after the Vienna meeting, found all the Monte Bolca plants without exception to be different from his 'Lower Miocene' (my Upper Eocene) flora. Heer showed me his plants of Swiss Miocene and Pliocene localities. The number of American forms is what he most dwells on. How abundant the plane trees must have been, and yet there is no indigenous European Platanus. But the insects of Œninghen struck me most. The colours of a *cimex* so well preserved, and of several species of *Buprestis*, and so many Brazilian forms as he makes out, especially a large hydrophilus, of which he had at first only the elytra, and yet he ventured to say it was a Brazilian form of the *Hydrophili*, and now the discovery of a perfect individual has proved it. But this was not guessing. They have a magnificent collection of living species of insects at Zürich, which it took Heer seven years to arrange. Of beetles alone, or Coleoptera, there are no less than 30,000 species!

The fruits and even flowers of some of the plants of Œninghen are wonderfully preserved.

A coprophagous beetle, '*Aphodius*,' in the Swiss lias, foretells the future finding of a liassic mammifer.

At Paris I learnt from a letter of Wyman, that he has at last an *Ophidian* from the old coal of Ohio—a great step—besides new batrachian bones. I also found Hébert hard at work. No less than five individuals of the large ostrich-sized Gastornis from the conglomerate under the Plastic-clay are now found, and with them a large lophiodon and crocodiles and a coryphodon.

Since I wrote what I said above about the controverted point where to draw the line between Eocene and Miocene, I have called on Deshayes, and he was reading the French

translation of my manual. He said he entirely agreed with me as to classification, hoped I should never give up, and would show me a multitude of new proofs which he had recently obtained by work in the field in the Paris Basin in support of my old plan (and his) of considering the 'Grés de Fontainebleau' as Upper Eocene, and as quite distinct from the Falunian type—an opinion which Edward Forbes thought demonstrated by his latest discoveries in the Isle of Wight.

Believe me, my dear Horner, ever most affectionately yours, CHARLES LYELL.

Paris: October 26.

To CHARLES BUNBURY, ESQ.

53 Harley Street, London: January 13, 1857.

My dear Bunbury,—Mr. Beckles called on me about a month ago, to show me the bones of the huge Iguanodon's foot (tridactyle, like a bird!) which he had found. I showed him *Stereognathus ooliticus*, then in my charge, and urged him to go and open a quarry at Swanage in the dirt-bed, and go after higher game.

He took me at my word, and soon wrote to say that the first day produced two reptiles, and the second a jaw (query if mammalian) which he sent me by post.

It was a new genus of insectivorous mammal! Mr. Bristow, of the Survey, then told me that Brodie at Swanage had been collecting for two years without sending to Owen. I wrote and begged for a sight of the new *Mammalia*, said to be found by him in the Purbecks. Up came a box from Brodie, and with three new species (of two new genera) of mammals, one as big as a hedgehog, and with the *skull* which Dr. Falconer interpreted to me. Then came box after box from Beckles, every day a new form of reptile or mammal, till I have got up to indications of twelve species of mammalia (including the original Spalæotherium) and nine genera!! The biggest is one-third bigger than a hedgehog. The last was made out by Falconer to have the dentition of the kangaroo rat, or of that family, with the back molars like *Microlestes* of the Trias! I have shown all to Owen, and he confirms Falconer's determinations. I am figuring this *Hypsiprymnodon microlestoides*—a pure vegetable

feeder! All these twelve are got from an area not larger than my drawing-room, and from a bed only three inches thick.

I have casts and beautiful drawings made at my expense when last at Stuttgardt of the Microlestes, and am much pleased at knowing what that oldest of yet found mammals was.

So the 'Noch-nicht-gefunden-seyn' (a capital specimen of a German substantive) of the Angiospermous plants in rocks older than the chalk, offer no reason to anticipate the rarity of warm-blooded quadrupeds. I asked Hooker whether he did not infer a rich mammalian fauna from the genera being almost as numerous as the species; he said judging from plants, a *poor* one! for in tropical islands the genera are very numerous proportionally, and the flora poor, but he added, they afforded no argument as to contemporary continents. But then, surely the number of species being almost as great as that of the individuals, argues a rich fauna.

Falconer reckons on large beasts as we go on. I am very glad of the cranium, a well-developed one, some evidence higher than lower jaws. Had these mammals turned up just above the Wealden, they would not have been so useful in warning men not to speculate on negative evidence in regard to no land creatures being found in aqueous deposits.

With my love to Frances, ever affectionately yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Bienne, or Biel: August 7, 1857.

My dear Horner,—You will have learnt from Mary's letters that we have been having a prosperous journey through Belgium and the old Rheinthal to this delightful country, which every time that I revisit it always seems more full of charms and wonders than at first. My visit at Liége was very useful, as besides talking over with Koninck the present state of Belgian geology, I got a full day in the Devonian rocks with poor Dumont's *locum tenens* (and I hope his future successor), young De Walque, who has published a good paper on the lias of Luxembourg. At

Aix-la-Chapelle I found Dr. Debey most ready to show me his splendid and unique collection of cretaceous fossil plants. I went with him to the hills in the neighbourhood to satisfy myself of the real position of the beds in which this new and peculiar flora has been detected, and the first hour convinced me of the principal fact, namely, that the sands and clays in which this vegetation is preserved are decidedly inferior to the white chalk with flints, which with the chalk without flints, and chalk marl, are of moderate thickness and rest upon a cretaceous greensand like some of our upper greensand, and immediately beneath this are the plant-beds. I found belemnites and numbers of our common chalk fossils. On the second day I made an excursion in a new direction in company with a younger geologist, Ignaz Beissel, son of a late merchant of Aix, who has entirely devoted himself to the marine beds above the Aachenian. I also paid two visits to a schoolmaster of the name of Joseph Müller, whose collection of the cretaceous beds of the neighbourhood is large, and who has published on them.

Dr. Debey thinks he has a hundred species of the Australian family, the Proteacea—of course I cannot judge whether he exaggerates the number, but certainly he allows many forms to belong to one and the same species. As Robert Brown, when I last talked with him about these plants being referred to *Banksia*, *Protea*, *Grevillea*, *Dryandra*, &c., suggested some difficulties and doubts, I was glad to find that Debey had been at Paris, and had shown Adolphe Brongniart some of his specimens, and he had agreed with Debey and remarked that the *Dryandra* was undistinguishable so far as the leaves go. But Debey has some fruits also, and he showed me the epidermis of some of the leaves so well preserved in the fine clay, that the cellular structure and the stomata can be seen under the microscope quite as clearly as in a living plant, and these stomata in the Proteacea are differently arranged from those in other families.

He has about fifteen species of Coniferæ; one of these agrees very closely in its leaves and the form and shape of the cones with *Wellingtonia*.

The ferns are most beautiful, some forty in number, many in fructification, and the spores bearing microscopic examina-

tion. But the numerous forms of ordinary dicotyledonous leaves are doubtless what will most astonish botanists, who thought that such plants made their first appearance on the earth in the tertiary period. Ettingshausen of Vienna is to publish jointly with Debey an account of the flora. It will be as remarkable a lifting up of the curtain which concealed from us the botany of the Chalk period, as the Purbeck discoveries are in reference to the land animals of the Upper Oolitic era. After I had come to a very strong opinion that these Aix beds and their plants were at least above the Gault, and below the White Chalk, I was told at Bonn that Ferdinand Roemer has lately published a paper expressing the same opinion, which I am glad to hear. I was much confirmed by seeing at Bosquet's, when I went over to spend a day with him at Maestricht, four genera of land plants found in the Maestricht chalk (two of them dicotyledonous angiosperms) *common* to the Aix beds.

It seems that the mineral character of the European cretaceous deposits changes rapidly after one crosses the zone of paleozoic rocks which run through Belgium and the adjoining parts of France and Germany, and the plants found by Debey grew, I presume, on some of the land formed by the dividing ridge of paleozoic rock (Carboniferous and Devonian) which parted the two cretaceous seas.

I picked up a few in the quarries. Among the monocotyledonous plants there are no palms, which I wondered at considering that they play a part even in the Miocene flora. I found much silicified coniferous wood in the sands. Araucaria has been made out by leaves and fruit. Some thin layers of regular coal occur here and there.

At Bonn I found Dr. Otto Weber, who has published on the Brown Coal Plants of the Siegberg district—a fine Miocene flora older than the faluns. Here again I was shown fossils of the genus *Protea*, and of *Banksia*, *Dryandra*, and *Hakea*, all of that Australian family which seems to have predominated in the Cretaceous, to have flourished largely in the Eocene, and to have figured still, though less largely, in the Lower Miocene. But I have since learnt from Heer that this family of Australia continued to exist in Europe in the Upper Miocene, and Gaudin of Lausanne has

even found one species allied to Dryandra in the Older Pliocene near Florence. As I had become interested in these plants I was glad to take a good look at them to refresh my memory in the garden at Popplesdorf, which were taken out of the conservatory. The gardener gathered leaves and flowers of *Protea* for me, and leaves of *Hakea*, *Banksia*, and others. You remember the large fossil frogs from the Brown Coal; they were contemporaneous with these plants, which lived when a great many American forms, *Liquidambar*, *Smilax*, *Taxodium*, *Comptonia*, &c., were abundant in Europe, and when the eruptions which formed the older volcanic rocks of the Siebengebirge took place. Von Decken went an excursion with me to Kessenich, where we saw the Devonian beds and the gravel of the higher platform, and where I told him how much light your Egyptian researches had thrown on the origin of the loess, which, as my views were rather different from those which Von Decken had proposed, led to some amicable discussions. He is a most agreeable companion and full of information, and I think very sound in his theoretical views.

The quantity of work which Hermann Von Meyer had been doing at Frankfort since I had seen him some twenty months before, surprised me as much as ever. He has a fair quantity of daily official business, after which he devotes his time most systematically to paleontology. He is his own artist, and a first-rate one. The economy of time and temper arising from his being able at once to draw what a scientific eye can alone see correctly, must be great, and will alone explain the prodigious amount of good work he is able to get through. When it is announced that he is going to write a monograph, every collector in Germany and many provincials in France send him their specimens. It is very rare that any are detained more than three weeks.

Thus in three years specimens belonging to 271 individuals of the Carboniferous reptile Archegosaurus were sent to Frankfort, and drawings made of all. It has produced a splendid monograph of the genus, comprising two species already in part published in the 'Paleontographica.'

Another on the Pterodactyles of Solenhofen has also been brought out by Von Meyer since I was last with him.

Yet he has now scarcely a fossil reptile in his house, after having described eighty species from the three members of the trias, and figured all. I found his table covered with some twenty new species of an Oolitic Crustacean of his new genus *Prosopon*, sent to him from various quarters. He draws on transparent paper, so that the lithographer turns it and sees it through, and therefore has not to reverse it. This greatly increases the accuracy of the copy.

Our windows here (Lausanne) overlook Gibbon's garden, in part of which the hotel is built. The view of the Lake of Geneva and the Alps very beautiful, and the weather not too hot. Mary is quite well.

Believe me ever yours affectionately,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Lausanne: August 10, 1857.

My dear Horner,– I am glad you have been thinking of the future as well as of the present of the Geological Society. . . .

. . . . My taking the office a third time is out of the question. I have done a fair share of that duty, and hope to continue for years travelling, making original observations, and above all going to school to the younger, but not, for all that, young geologists whom I meet everywhere, so far ahead of us old stagers, that they are familiar with branches of the science fast rising into importance which were not thought of when I began. Such is the case with young Gaudin here, a fossil botanist who in age might almost be my grandson.

When a vacancy occurred in the Institute by Buckland's death, Elie De Beaumont sent me word that there was a party for me, but that he should use all his influence in another direction. I presume that his motives for this extraordinary message were various. He had lately received hospitality at my house in London, and had been as usual on most courteous terms; in Paris always ready to furnish me with unpublished Government maps of France, &c., and he may have wished to act openly and frankly; also to let me

know in return for my enmity to his opinions (or as they always say in Paris) to himself, '*mes ennemis*,' &c., meaning 'my theoretical opponents,' that he had the will and power to thwart me in what he really imagines is the great object of everyone's ambition. His message did not open my eyes to his course in the election, for I knew that before, but was a gratifying testimony to the existence of a party in my favour.

It would be the height of the inconsistency of human wishes or expectations, to receive the compliments paid me by the younger geologists since I left town, and at the same time to expect the opposite, older, and more influential men of science to confer honours on the leader in a new school, and as they think heresy.

Prof. Bunsen at Heidelberg avowed at the dinner he gave us that all his taste for geology had been derived from my writings. Here is a man whom many in Germany rank above Liebig. He is aware how I am opposed to many prevailing opinions. Marcou, in writing to me about my 'Supplement,' tells me he is gradually coming round to all my opinions, even my theory of climate. Morlot at Lausanne writes to say that he has been giving lectures in that town, using my 'Principles' as his textbook, 'for he is one of my school.' Cotta, my translator, writes in the same strain, all regarding me as the head of an opposition party, opposed to those who still on the Continent, and especially in France, have the power in their hands.

In one of my last conversations with De Beaumont he used the word *étranger* in reference to some eminent French geologist—I forget whom. I exclaimed that I always thought he was a Frenchman. He explained that he merely meant not a member of the Academy. I was so much diverted and surprised at this classification of all scientific men into those who did, and those who did not belong to his Academy, that I betrayed my amusement. He went on to assure me that it was the way in France to speak of those who were not in the Institute as foreigners, *étrangers* (outside barbarians). He imagines that to get into it is the great object of every man's ambition.

Believe me ever very affectionately yours,

CHARLES LYELL.

To Leonard Horner, Esq.

Zürich: August 15, 1857.

My dear Horner,—We have returned to our beautiful room here, or to one which has the same views of the Lake and the Alps, having made a most successful tour through no small part of Switzerland, by Soleure, Neuchatel, Lausanne, Vevay, Freiburg, Berne, and Aarau. But I must try and resume my sketch of my geological proceedings. I said something of the day which Hermann v. Meyer, with his usual liberality, gave up to me. He lives very isolated at Frankfort, though in communication with all Germany and part of the French provinces, and when anyone calls who appreciates his labours, it must do him good.

Wishing to make an excursion, I got Professor Kaup of Darmstadt to introduce me to a Major Becker, of the Darmstadt Engineers, a geologist, who drove with me into the Odenwald, and showed me Rothliegendes, various trap rocks, and some tertiary limestone of the Mayence basin (Lower Miocene). I was not a little surprised, just when taking leave, to find that my companion was a brother of Becker, the Prince's secretary.

At Heidelberg I had some good talk with Professor Bunsen on the theory of glaciers; Tyndal versus James Forbes, &c.; and Professor Blom showed me many fossils illustrative of the triassic rocks of the neighbourhood and the Odenwald, and also of the Permian. They have made out the age of their sandstone, Bunter, &c., better than I had imagined. The Rothliegendes is certainly very angular in its pebbles in that region, though not so much so as you found at Eisenach.

Professor P. Mérian at Basle invited us to his country villa, and told me who was, and who was not at home. I missed Fridolin Sandberger at Säckingen on the Rhine, which he had just left, but was lucky enough to find Heer at Zürich, disposed to devote as much time as I could give to show me his collection and talk over Swiss and German tertiary geology. He had lately returned from Italy, or at least had been there since I was here last year, and had seen De Zigno's oolitic plants at Padua. Charles Bunbury

will be curious to know that after great accession from all countries this flora remains exclusively confined to Cryptogams, Cycads, Conifers, and without any dicotyledonous angiosperms.

I perceive that Heer is trying to frame a progressive theory for plants, though he is a good deal put out by finding a Paleoxyris in the Coal, one of the Bromeliaceæ. In fact the monocotyledons do not seem as yet to keep their place in the chronological system as they should do if they knew their real rank in the order of development. Some of them appear before their time. It is, however, striking to observe that the tendency of geological facts (or opinions) carries a man who is working in a new field, and an independent thinker, into the speculation that nature began with cellular, and went on to vascular cryptogams, from lichens and seaweeds to ferns, and slowly got up to Coniferæ and Cycads, then to different divisions of dicotyledonous, apetalous, polypetalous, and gamopetalous in the order of their perfection. Although Heer is too well aware of the exceptions to his rules, and even of the impossibility of classing the dicotyledons correctly according to relation, dignity, or perfection, yet the attempt shows how seductive such a generalisation is. So long as it is admitted that man came last, and the idea of progress is cherished as the only way of uniting that fact with paleontological data, I suppose these views will find favour. It seems the only prospect of a complete system, of uniting all into one grand whole, the supposed absence of fish in the oldest rocks, with the coming in of the Mammalia last of all, and with a parallel series of progressive steps from the algæ to the lilies and the roses. But it might be better if we were rather less ambitions. This eager desire to solve the whole problem may mislead zoologically, botanically, and geologically. I suppose most men prefer a doubtful system which enables them to group together a great many facts, than to have none. I spent three days in Heer's collection. He is continually finding fruits which bear out the generic determinations previously obtained from leaves alone. The fruit of *Cinnamomea camphora* among others, the leaf of which was so well known, also certain maples common to the lower and upper molasse,

as are a great many plants, helping to link together what I now call Lower with Upper Miocene, and justifying my substituting the former term for Upper Eocene in reference to the Mayence basin, Hampstead, Isle of Wight, &c. What is singular is this, that Heer finds all the insects and plants, 1,000 species of the former and 700 of the latter, from the freshwater molasse, to belong to extinct species, whereas the marine beds which separate the Lower from the Upper molasse contain *shells* like those of Touraine or the faluns of the Loire, of which a third are recent. Possibly some of the plants may be identical with the living, though Heer has apparently good grounds for distinguishing them, often by the fruit, as distinct. But the more one examines his specimens and hears his reasons, the more faith one has in him and in fossil botany. I now have little doubt that the whole of the Œninghen beds are Upper Miocene.

Heer convinced me that the Madeira plant sent to him from S. Jorge was the *Oreodaphne fœtum*, and if Charles Bunbury found *Laurus Canariensis* among mine, it must be because both are there, which is not improbable. The glacial phenomena appear to me more than ever wonderful. There is much lecturing here in small places, very like the United States. I met with a M. Zollikofer, who has done good original work in the Italian glaciers, starting to lecture to the watchmakers of Chaud de Fonds and ten other places.

Ever affectionately yours,

CHARLES LYELL.

CHAPTER XXX.

AUGUST 1857–SEPTEMBER 1857.

LEAVES ZURICH TO SEE THE LIMESTONE QUARRIES OF SOLEURE—GLACIAL PHENOMENA IN SWITZERLAND — THE RHONE GLACIER — ZERMATT—VIESCH—THE MATTERHORN.

CORRESPONDENCE.

To LEONARD LYELL (*six years old*).

53 Harley Street, London : April 13, 1857.

My dearest Leonard,—Mrs. Nisbet[1] brought me the Actinia on Saturday evening, and the next morning Aunt Joanna took it to the Zoological Gardens, where I have since seen it, looking quite well, and likely to live till you come back.

There are a good many of the same species (*Actinia Mesembryanthemum* is the name of it) in the Fish House, and almost every one of them differs a little from the other, and I could only see one which resembled yours in colour, and that one was not exactly the same. It is what naturalists call a variable species.

I am not sure that zoologists understand the meaning of that beautiful row of blue tubercles which surround the base of the feelers or tentaculæ. Some individuals seem not to have them.

If I can manage to run down with Aunt Mary to Brighton some day before you return to town, we will see what we can find on the beach when the tide goes down.

With my love to Frank and Arthur, believe me your affectionate uncle,

CHARLES LYELL.

Give Rosamond a kiss for me.

[1] The faithful housekeeper, who was forty-three years in his service.

To LEONARD HORNER, ESQ.

Zürich, St. Gallen : August 16, 1857.

My dear Horner,—From Zürich we went partly by rai. and in part by voiturier to Soleure, where I went to see the quarries of 'Portlandian' white limestone, almost a marble, in one bed of which all the turtles (of several genera) have been found—all it is said with the carapace upwards and the plastron down, a position in which they might be expected to settle. The most striking phenomenon in these large quarries at Soleure was an extensive shelf of the limestone, from which a covering of about eight feet of solid unstratified mud, full of angular and subangular boulders, had just been removed. These boulders, with now and then a block large enough to be called an erratic among them, were many of them striated, polished, and scratched on one or on all sides. But the ledge of limestone below was smoothed in the most beautiful style, as well as traversed with parallel furrows. The sections of innumerable large *Nerinæa* on the surface of the polished ledge made a beautiful show. There is no rock which receives and retains glacial markings so readily and faithfully as a compact limestone, provided it be covered with mud by the glacier, for it loses all its striæ by a few months' exposure in the open air. It is singular to observe what a heavy and solid thing this fine mud, called 'glacier mud,' is. Perhaps it has often been pressed under a great weight of ice. They have discovered lately in the railway excavations that they can advantageously blast them with gunpowder. The erratics here are part of the supposed doings of Charpentier's great glacier, which walked across the great valley of Switzerland from Monts Blanc and Rosa to the Jura, with a thickness of ice of some 4,000 feet, then abutting against the limestone chain, and rising nearly to its culminating ridge spread itself on each side, after leaving Pierre à bot (the *toad* stone) above Neuchatel, and some still more enormous angular masses on the cretaceous and oolitic rocks of the Secondary Chain.

In order to escape from the necessity of appealing to such a gigantic mound of ice, I ventured, you may remember, to

suggest that the sea may have floated the Alpine erratics to the Jura, as Darwin has shown that the ocean now carries on ice rafts the rocks of the Andes to Chiloe, arranging them there with no small regularity. But the entire absence of marine remains in the associated gravel, mud, and moraine, whether here or anywhere in Switzerland, the conformity of the distribution of the travelled blocks here with the shape of so many valleys, and above all, the sight of the Alpine snows at Berne and elsewhere, has made me strongly incline, with Charpentier, Agassiz, and others, to embrace (as James Forbes did) the theory of a terrestrial glacier. With Desor at Neuchatel, I revisited Pierre à bot, and saw the zone of blocks of the Monte Rosa talcose granites and gneiss at one level on the Jura, and the Protogine blocks of Mont Blanc at another. Afterwards Morlot accompanied me from Lausanne to a spot in the middle of the great valley between the Lakes of Neuchatel and Geneva, where the glacial appearances are splendidly displayed; and lastly, when I had got out of the domain of the colossal glacier of the Rhone (or the Vallais), and at Berne was in the region of the supposed ancient glacier of the Aar, I had a grand day with Escher von der Linth, and went over all the arguments for and against the land- and the sea-ice theory, examining the old moraines around Berne, and 'the gravels' (as Blackadder used to call them on Strathmore) or the stratified old alluvium consisting of rearranged (or *remanié*) boulder stuff, which have been thrown down by rivers since the retreat of the ice. At Berne Escher pointed out to me that on the right side of the moraine of the Aar, you have fragments of the rocks which, far above the Lakes of Thun and Brientz, belong to the right side of the valley of the Aar, and on the left side those derived from very different formations occurring on the left side. It is evident therefore that the two lakes were then full of ice. Another interesting point is this. It is clear that a greater glacier like that of the Rhone coming down the Vallais—filling the Lake of Geneva—rising as they assume 3,000 or more feet above its level, and crossing to the Jura, must have blocked up the mouths of the minor or lateral valleys. Places were also pointed out to me, one of them near Vevay, where the old colossal masses of ice of the Rhone-glacier blocked up

tributaries which in summer brought down pebbles at points far above the level of the Lake of Geneva, 1,000 feet or more. At these points of junction a mixture of stratified alluvium proper to the said tributary torrent, and of unstratified mud and blocks from the Vallais, are observed in spots on which it seems most unnatural for any such accumulations to have taken place, unless one admits Charpentier's theory or some modification of it. Now, just such old moraines of mixed character, called here 'diluvium glaciare,' are observable in Forfarshire at the openings of lateral valleys into the larger one of Clova, or Water Esk, only explicable by imagining the deeper glen to have been once filled with ice. Indeed, if the hypothesis now generally adopted here to account for the drift and erratics of Switzerland, the Jura, and the Alps be not all a dream, we must apply the same to Scotland, or to the parts of it I know best. All that I said in May 1841 on the old glaciers of Forfarshire (see 'Proceedings of the Geological Society' for that year) I must reaffirm, and the glacier of the Rhone is comparable to our principal one of the Tay, which came down by Dunkeld and by Coupar to the south of Blairgowrie, and then through the lowest part of Strathmore, characterised occasionally by masses of actinolite schist which could only have come down from the valley of the Tay. This glacier went across the strath, and in a straight line by Forfar to Lunan bay, where it reached the sea, being traceable by its *débris* for a distance of thirty-four miles, and therefore by no means unworthy of comparison with some of the old Alpine ice rivers. And we have also in Angus our 'Pierres à bot,' as I stated in my paper on the Sidlaw range, which is our Jura. The block of mica schist which I measured on the hill of Turin, a hill 800 feet high, resting on the Old Red Sandstone within forty feet of the summit of the ridge, was thirteen feet long, and must have come from the Grampians, probably very far from the north-west. It is a fine monument of the transporting power of ice, as displayed in Scotland, but Pierre à bot is really more wonderful when seen again, than when I first beheld it, so vast and angular, so clearly resting on a limestone chain, with the great tertiary valley between it and the Alps. There can in the first place be no doubt that ice was the carrying

power, and the distance travelled by such blocks and others is the same whether our hypothesis employs floating ice or a land glacier. Escher has pointed out to me that in several cases where the valleys bend at sharp angles, as in the case of the Rhine above the Lake of Constance, the floating ice is out of the question. He has established this by the aid of a very peculiar rock called the granite of Pontelyas, near Trons. Fortunately this granite is exceedingly unlike any other in Switzerland or the Alps, large regular crystals of common felspar in a base of green felspar, with another dark mineral (I forget the name) dispersed like mica. As fragments are traced from its starting point we have positive proof of its origin. I told Studer, Escher, and Morlot that I was disposed to embrace fully the land transport theory, but I thought they took too little account of the probability of considerable and unequal upheavals. When we consider that in Scotland, on the Clyde side, we have post-glacial upheaval to the amount of between 200 and 300 feet, and 1,500 feet in Wales (Moel Tryfane), and 700 or more in Canada at Montreal, how much more may we presume that in and near the Alps (which I take to be the greatest centre of movement in the later geological periods of all Europe), there will have been vast and unequal changes of level after the dispersion of the Alpine blocks in all directions, northward, southward, &c.!

I am happy to find that Escher, who knows the geology of the Alps more minutely than anyone, has quite realised the idea of the probability of its great foldings having been effected very slowly, and that the lateral pressure exhibited on both sides may have been brought about at the same slow rate at which the central nucleus crystallised, and in the act of crystallising expanded. Even the Eocene strata turned slowly by metamorphic action into granite and gneiss in some places.

I ought before this to have told you that after diligent search the geologists have been unable in any part of Switzerland to find a single marine shell in any moraine, or any part of the boulder clay. In this respect the glacial formation is precisely what I know it to be in Forfarshire; and as our Scotch gravels, with the exception of a few

patches near the sea, and not many feet above its level, are also without such remains, so here the stratified gravels formed since the glaciers retreated, and often 200 feet thick or more, are without them. This to be sure is mere negative evidence, but lately Morlot has detected some wood very well preserved in an old moraine (700 feet thick) opposite Lausanne on the Lake of Geneva, and at Lausanne itself in a similar position the bones of the marmot, the living species (*Arctomys*) in unstratified boulder mud, full of striated and polished pebbles.

In regard to my belief in the greater height of the Alps and other modern changes of level, I cannot say more than that this important mode of facilitating the explanation of the phenomena has been far too much neglected. My idea is that all the mountain chains, lakes, and valleys have remained as before, and I quite agree that none of those astonishing lateral-pressure folds can be of post-glacial date. But when all northern Europe was colder, an addition of 2,000 or 3,000 feet to the altitude of the greatest chain would have had a prodigious effect in the local augmentation of cold and ice, and if the same causes which at several distinct and successive geological epochs, have produced more movement in the Alps than almost anywhere else, did also in the glacial and post-glacial period contribute to intensify the Alpine as contrasted with the Jurassic oscillations of level, the slope down which the streams of ice crept along may easily have been greater than now. A generation must die off before geologists will know how to make use of an ample allowance of time,

Ever affectionately yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Altorf: August 29, 1857.

My dear Horner,—My last letter on the geology of my tour related chiefly to glacial phenomena, and before I get among the glaciers themselves, which we are fast approaching, I must try and make up an arrear of some ten days or

more during which I have seen much of the tertiary, and something of the secondary rocks of Switzerland, and a good deal of their geologists. Mary will have told you of my having attended the meeting of the Swiss naturalists. I was tempted to do so by hearing that their doings only lasted three days, and that it was very easy to see and converse, instead of listening to long and often dull memoirs. There is also much brotherhood among these Swiss. They give me very much the idea of men who meet together for mutual instruction, and as real lovers of natural history and science. I saw most of Heer and Escher, Mousson also of Zürich; Mérian of Basle, Langen of Soleure, Gaudin of Lausanne, De la Harpe of do., all men whom I had seen in my tour, were present; also Ziegler and Desor. Trogen in Appenzell, where they met, is near the boundaries of the tertiary (molasse) and Alpine region.

When you see Falconer, pray tell him that I visited all the localities in which the Zürich proboscidians named by him in their museum had been found. The *Mastodon angustidens* of Winterthur has proved a splendid fossil. The story has gone through all Switzerland how Falconer threw up his cap to the ceiling when he saw it. According to his suggestion it was sent to Kaup, and it turned out, as Falconer thought, a nearly entire specimen; upper and lower jaws, in one of the latter the second tooth seen below the milk tooth. Also the incisor. Moreover a young Mastodon of the same species. It is from the Upper molasse. I visited the quarry,

I also went to Dürnten, and saw the beds from which *Elephas antiquus* was extracted, and Falconer will be glad to learn that I obtained a tooth, which though not perfect, I feel almost certain is *Rhinoceros leptorhinus*. The shells *Valvata* and *Cyclas* of living species. The plants also (Heer was with me), *Pinus abies*, *P. sylvestris*, *Betula alba*, *Phragmites vulgaris*, and a few more. No *Cyrena* as yet. The dip of the beds Escher suggests may be due to subsidence when the valleys were cut through the Pliocene, and when the water was withdrawn from this peat-like deposit. He says the molasse is quite horizontal below. At first I hoped I had got a decided case of post-pliocene upheaval or change

of position in Switzerland, to favour my post-glacial oscillations mentioned in my last. But I fear that the subjacent undisturbed molasse precludes this inference.

By the way, talking of Escher and upheaval, I was not a little pleased to find how thoroughly he goes with me in doing things slowly. No one in Europe is so well acquainted with the stupendous folds and inversions of strata in the Alps, and yet he believes it all took place without any interruption of the habitable state of these mountains. Had man been there, he thinks he would not have known what was going on.

I end this at Visp, where the walls of most of the houses are rent with the earthquake which shook them two years ago. Perhaps after all there *is* something still in progress. The shocks were felt for 300 miles by 200.

Yours very affectionately,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Domo d'Ossola: September 10, 1857.

My dear Horner,—We received your letter of September 5th at Visp, and shall leave Mary to answer it, and continue my sketch of the geology of the country we have lately visited, where among other things I have seen the glaciers of the Rhone, of Zermatt, and two smaller ones adjoining it, those of Zmutt and Findeln, besides that of Viesch which Escher recommended me to see, and which comes down from the Bernese Alps towards the Vallais, whereas the Zermatt group descends from the region of Monte Rosa. I think I have learnt a good deal, for I have been surprised at finding the signs of glacial action diminish so rapidly in proportion as I got nearer and nearer to the glaciers, until it became least evident when I stood on and touched the glaciers themselves. You will remember that when I was at Soleure, 150 miles from the source of the supposed ancient Rhone-glacier, I was struck with the quantity of polishing and grooving and scratching of the limestone rocks, and of the pebbles in the old moraine or unstratified mud. The

erratics also on the Jura there, as well as near Neuchatel, and the moraines of gigantic size 800 feet deep at Lausanne or opposite it on the south side of the Lake of Geneva, struck me much, and near Trogen and Winterthur and round Zürich, it is wonderful how abundant are those peculiar memorials of ice-action which neither the landslip, nor the avalanche, nor the vibrations of the earthquake, nor any known agent but ice can produce, and which the torrent whether of mud or water cannot cause, but on the contrary immediately effaces.

I had imagined that as the Reuss has strewn the country below the Lake of Lucerne with erratics and glaciated (or polished, furrowed, and scratched) blocks and pebbles, that when I followed for a day and a half's journey the valley of this same Reuss up to its source from Altorf to Andermatt and beyond, I shall find the evidence of the old glacier still more clear. But I positively could not find one proof, except some talus-like moraines and two or three *roches moutonnées*, of ice-action. Had I searched longer I should no doubt have met with them, but I had expected them to obtrude themselves on my notice as they do in the low country of Switzerland far from the Alps. Crossing the Furka I came down upon the glacier of the Rhone, examined its lateral moraines (of small size), the blocks on its surface, and afterwards its terminal moraine, with a view of ascertaining what proportion of the stones, whether angular or rounded, had been so dealt with by the ice, that if I brought any of them away, they would be recognisable as *glacial* by a practised eye. I began to count, but not finding one in a hundred, no, nor in two hundred, was soon tired out, and I repeated the same experiment afterwards on other glaciers and with the like result. Several times when I and three or four companions (guides and volunteers) looked sharply for hours in the moraines on or around the glacier, we observed a few good examples of smoothed and scratched boulders which were unmistakable, but they must each have made one only in many thousands—a singular contrast to what we witness when we go far away from the spots where alone Nature is now manufacturing specimens of this peculiar kind.

As to the medial moraines which travel down on the sur-

face of the ice, I do not see how we are to expect any fragments of rock in such a situation to differ from the talus of the foot of a precipice, except occasionally that such moraines have had some friction between the ice and the rocks which bounded the tributary glacier. And in regard to stones which have been ground against the bottom, I cannot help suspecting that after glaciation they most of them get rolled by the powerful torrent which runs beneath the glacier for many miles, and bursts out usually from a large arch at the end. The triturating power of these Alpine torrents is enormous, and in a short distance they would obliterate every groove and scratch.

In the glacial period, when the weight of ice was enormously greater, when in the region of the Alps there was so little melting, when glaciers at present only ten, fifteen, and twenty miles long and from 300 to 1,000 feet deep, were 50 to 100 or even 150 miles long, and 4,000 feet deep (and if there is any truth at all in the generally received theory of the old Swiss glaciers such must have been their gigantic dimensions), one may readily grant that the pressure and friction were so much in excess of what we now see, as to explain the contrast between the ice work done in the olden times and that accomplished in our own days, to say nothing of the probably disproportionate length of the periods compared.

But you will naturally say that I am going too fast in assuming that the glaciers are a *vera causa*, and adequate to do all, if only enough of time and of cold be allowed. This is the great question, to answer which I came this year to the higher Alps, being desirous to see the proofs with my own eyes. I began with what I *did not* see, because taking me by surprise it made the greatest impression on me, and because it removes many difficulties which I had in Forfarshire, where in passing through Clova, and over the granitic portion of the Grampians as far as Deeside, I was disappointed at missing good evidence of glacial striæ, &c., although I believe there were glaciers there in the glacial period. Our Scotch erratics, our *till* or unstratified moraines, and in some places our dome-shaped rocks or *roches moutonnées*, are just what we find here even in those places where it is excessively difficult to meet with smoothed pebbles or blocks with parallel

grooving. It seems that most granites and nearly all the crystalline schists will not readily take or retain such markings. Limestone, and still more Serpentine, are the best, but the limestones must not be exposed to the atmosphere, or they soon decompose superficially and lose their distinctive markings, and I have examined blocks even of these calcareous and serpentinous stones by hundreds on the glacier and in its moraine, without meeting with any indubitable signs of glacial action. Such negative facts have surely not been dwelt upon enough by Agassiz and many other writers on this subject. But now for what *I did see*. First, the small size of the lateral moraines of the Rhone Glacier some way above its termination, and the equally small scale of the terminal or frontal moraine of the same, astonished me. I saw afterwards some twice as big (thirty-five feet high perhaps, and twenty or thirty broad), and I have read of some much larger. The old moraines of Switzerland are 150 and 200 feet high, to say nothing of that one opposite Vevay and Lausanne, said to be 800 feet. I suspect that Zollikofer, in saying that the lateral moraine of the glacier of Macugnaga S. of Monte Rosa is 150 feet high, means the old moraine of the extinct glacier, for he speaks of vegetation on it, whereas I never saw even a lichen on any recent moraine. Hooker I think saw recent moraines in the Himalaya 200 or 300 feet high! The steepness of the modern terminal moraine of the Rhone on both sides, and of others since seen, at angles of between 35° and 45°, and so sharp at the top as scarce to afford room for one's foot, is singular. There is an old terminal moraine 120 yards in advance of the new one of the Rhone Glacier, covered with wild plants, some in full flower, and cut through in two places by the river, showing entire absence of stratification, its height only fifteen feet, width 90, slope in parts 37°. The next I saw was the Viesch Glacier above Brieg, or in the Upper Vallais.

Although it is annually advancing, yet the melting back of its termination during the heat of this unusually hot summer, gave me what I wanted, an opportunity of seeing under it, or of observing the floor of granite on which it had pressed eight months before. My guide took me under an arch of ice, and I saw a rounded and domed surface of

granite, smooth and with straight furrows, a quarter of an inch deep, exactly in the direction of the onward movement of the glacier. Although there is usually a dripping of water from the ice in such places, it was so dry here that I had to blow out of the rectilinear grooves the fine polishing powder as it has been called. Not only were there furrows on the top, but also on the sloping sides of the granite boss, and they were also nearly parallel to the others, because I suppose the plastic (or viscous?) mass of ice, with stones frozen into it, enveloped the granite, and moving the whole of it forward in the same direction, cut channels in the sloping sides as well as on the tops. All this was what I had read about, but I was pleased at seeing another sign of the freshness of the action of the glacier. Some dark-bluish slate rock had left streaks of colour which I could wash off—it could not grind the granite, but had lost a portion of itself and left its mark on the granite. A short distance away from the new moraine are abundant signs of old moraines and *roches moutonnées* and rocks *in situ*, grooved in the direction of the valley, but I had not time to look for striated pebbles. I could find none in the existing moraine, only one imperfectly furrowed piece of mica-schist.

Next I explored the Zermatt Glacier, two days at its termination, and another day high up above its middle portion at the foot of the Riffelhorn, crossing it and seeing all the medial moraines. A few years ago this last examination would have required one to camp out. Now an hotel more than 7,000 feet above the sea, renders it easy to one who is not fatigued by a mountain ride, and who can stand half a day's walk over the ice. One of my guides had acquired a keen eye for glacial markings. I was assisted by an intelligent Swiss, the young landlord of the Riffel Hotel, also by Mr. Sclater of Oxford, whom I had met at Sir W. Jardine's, and by another of my guides. After hours of search, I began to despair of ever seeing amongst thousands, one truly glaciated transported or travelling block. At last, under the Riffelhorn, on the right lateral moraine, we saw a splendid angular mass of granite which measured in length 59 feet, width 49, height 42 *Paris* feet (I had borrowed a tape measure of 45 feet on the French scale); nearly all of

one of its sides was beautifully polished and furrowed, while the other sides were perfectly rough. In some places a very distinct set of small scratches parallel to each other, but not to the prevailing grooves, were visible. By confining our attention to the green or serpentine stones, we obtained here and elsewhere in the modern (and in the ancient moraines which appear in the same valleys at heights of several hundred feet) a very few well-scored pebbles, and now and then in the old moraines a fine surface of serpentine, with two or even three sets of striæ.

The rapid advance of all the glaciers I have visited is manifest. In the chaotic mass which the terminal moraine of Zermatt (or Görner Glacier) presented, I saw beams of wooden chalets and roofing tiles. In the moraine of the Zmutt Glacier I remarked a large rock with lichens on it. This was so unusual that I walked round it, and found on the other side of it a fine larch tree with its leaves still green. I then discovered that the glacier had closed round a small island of rock covered with large larches, and had detached several huge fragments of the rock, and pushed them into the moraine. Farther on I found on the outer slope of the moraine, which was fifteen feet high, and sloped at 35° to 46°, no less than eight large larch trees with their roots buried in the mass of mud and stones, and their boughs and trunks protruding in horizontal and oblique directions. Both in the Zermatt and Findeln glacier-moraines I found fresh green turf of meadows rolled up and mixed confusedly with the mud and stones. I was shown some meadows where the Zermatt Glacier had penetrated some eighty feet last year, although in other places it had moved forward much less. Wishing to determine its average rate of progress, and learning from the curé of Zermatt that it had reached a certain brook which descends from the Furg Glacier sixty years ago, I mounted the glacier with two guides, and measured the distance, which gave a mean annual advance of forty-three French feet. In the last sixty years it has walked over the site of forty-three chalets of men or beasts; three very lately. They usually remove most of the woodwork before the ice comes and shoves the moraines against them.

To one in search of the recent doings of the ice, or wanting to study the geological monuments which an extinct glacier would leave to after times, it would be more advantageous to visit the Alps in a period of recession. One wishes to see what is going on at the very bottom, where the pressure and friction are greatest. I often congratulated myself that I was not trying to convert a sceptic by showing him what a glacier in full activity could do. It is like taking a Wernerian who denied the igneous origin of trap to a very active volcano, such as Vesuvius. He would see nothing but cinders and fireworks, and, for lack of power to observe what was doing far below, would go away a worse sceptic than he came. But, thanks to the summer heat, I saw enough to make me believe the more abundant evidence which others have seen in those glaciers where the rocks are more favourable to a display of polished and scored surfaces. Even the few I found imply the existence of thousands, just as if you find one or two marine shells in a deposit after searching a day or two, you expect that time and patience may bring to light a whole marine fauna.

On visiting the Findeln Glacier I ascertained that it is in full march forwards, ploughing up the meadows and felling fir trees, and has been so for two years at least, and has gained, they say, still more remarkably in height, above sixty feet in advance, and more in altitude, so say the neighbours. Before that time they say it was stationary.

Its aspect is to the south of west, that of Zermatt NNE.; and if, as Darwin says in reference to the Andes, the amount of summer heat has more to do with the growth or decrease of a glacier than the quantity of winter's snow, such a difference of aspect or exposure to the sun and certain winds may go for much, at least for a few years, though when there is a continued augmentation of snow on this part of the Alps, and of glacier ice, all the glaciers of the same group must eventually share in the same movement. At present the fear of the Findeln (or Findelen) people is that their enemy is now making up for lost time. I was able to ascertain by means of a water-lead constructed a month before my visit at the end of the Viesch Glacier, that the ice

had melted down, or lost in height, exactly five feet at its termination in the preceding four weeks.

Nothing can be more satisfactory than the identity of the fresh-made moraine to that older one which is often found at a short distance in advance of it, and of larger size, as in the case of the Findeln one. The same sharp sand and fine impalpable mud, making a mortar-like cement when baked in the sun, in which large and small angular stones, some few of enormous dimensions, are buried. When you trace the same formation almost continuously to the lower country, or find what may have been old lateral, and occasionally terminal moraines here and there with transported blocks, belonging to, or derived from mountains in the higher part of the same system of valleys, and accompanied with scored pebbles increasing in number as you descend, and with erratics and *roches moutonnées*; the whole leaves you no alternative but to infer that one and the same cause or *modus operandi* has prevailed throughout the whole area.

Even the marked multiplication and intensifying of the glacial agency, the farther one gets from the modern pigmy glaciers, seems to me now to militate against my former idea of employing floating ice to carry the far transported erratics to the Jura and other distant points. I want the grinding force of the denser and broader glacier which most of the Swiss naturalists have appealed to. The ice-rafts will not supply it (the more extended land-glaciers would). But here is enough in all conscience for one bout, so I must give you a respite. I have said not a word of the splendid scenery of the Monte Rosa Alps. The Mont Cervin or Matterhorn is as wonderful as J. Forbes represents it. Every day, as I saw Monte Rosa and some of its gigantic neighbours from new points of view they gained upon me, and had I stayed longer I might have doubted the justness of my first impression, that the Zermatt scenery, though grand, was not comparable to Chamounix. At any rate, it has the merit of being quite different. No one peak, not even the Matterhorn, can compare with the forms of the Aiguilles of Mont Blanc. We were greatly favoured with fine weather.

Ever most affectionately,

CHARLES LYELL.

CHAPTER XXXI.

SEPTEMBER 1857–DECEMBER 1857.

TURIN—GEOLOGY OF THE NEIGHBOURHOOD—EVIDENCE OF GLACIAL ACTION—VEGETATION OF THE RIVIERA—ZWERGLETHURM, NEAR VIESCH—VISIT TO LEGHORN—TOMB OF FRANCIS HORNER—MRS. SOMERVILLE AT FLORENCE- NAPLES—ROME—THE CAMPAGNA.

CORRESPONDENCE.

To LEONARD HORNER, ESQ.

Genoa la Superba : September 21, 1857.

My dear Horner,—It is more than a week since I last wrote to you after my arrival in Turin. In that city I found several able geologists, especially Gastaldi, now employed in the administration or chief management of a Government Polytechnic Institution. Sella, a mineralogist and mathematician, and others aided me. Last year, when at Vienna, I heard the *savants* of Italy much run down by the Austrians, but I am sure they only require fair play, and they are quite equal to those of Germany. I did not see Plana the astronomer, nor Babbage's friend Menabrea, for it was vacation time, and the heat had driven all away before we arrived. You remember Playfair, when he visited this country, said it was more likely to produce a Newton than we in Great Britain to produce a Raphael. I believe them to have naturally an aptitude for science.

I made many excursions in splendid weather, accompanied by Gastaldi, and in one case by him and Michelotti, who has published a work on the tertiary Lower Miocene shells of the Superga. I have now had an opportunity of comparing the strata containing these shells and others immediately below them with the 'molasse' of Switzerland,

which they resemble somewhat mineralogically as well as in their fossils ; but a good deal has to be done before an exact parallelism of the successive sets of Miocene beds on each side of the Alps can be made out. I have, I think, made a beginning, and as there are some plants in the Turin or Bormida series which I have urged Gastaldi to send to Heer of Zürich, I expect we shall soon obtain much valuable botanical aid from his identifications.

A comparison also of the extinct glaciers of the Italian and Swiss sides of the Alps can better be made from Turin than from any other place. Before my arrival I had seen on the banks of the Lago Maggiore some good examples of erratics and of moraines which had come from the Simplon, but these, as you might suppose *à priori*, are far inferior to those which have descended from the Val d'Aosta or which belong to the ancient mighty glacier derived from the combined snows both of the Mont Blanc and the Monte Rosa group of Alpine heights. This glacier, although perhaps of less gigantic dimensions than that of the Rhone, has certainly left, as Gastaldi first pointed out in a memoir on the subject in the French Bulletin, a far more imposing monument of itself on the plains of the Po than have the extinct glaciers of the Rhone or the Rhine in the lower country of Switzerland. You may well imagine that having fresh in my memory the proofs enumerated in my last letter to you of the recent advance of the Viesch and the Zermatt Glaciers for a series of years, I was prepared to accept willingly (and after my geological experience north of the Alps, to expect) evidence of former extensions of the icy masses.

J. D. Forbes has well shown in his book on the Alps that a glacier is a peculiarly sensitive instrument for measuring the annual average of heat and cold, and that every slight difference of temperature causes it to increase or lessen in height and length. If therefore we had come to the conclusion paleontologically by the greater southern range of arctic shells and quadrupeds (e.g. the musk buffalo and reindeer) that the cold once reached to lower latitudes than it does now, and this at a period geologically speaking very modern, we ought to look for signs of glaciers belonging to the existing mountain chains on a scale corresponding to the

wintry climate implied by the southward migration of species the habits of which are well known to us. Not that I believe that geologists of this or the next generation would have got so far as to miss the phenomena which we are now only beginning to interpret correctly. I have often thought, would the rainbow have been missed by the most profound philosophers in optics? and yet it is as necessary a result of certain meteorological conditions as the glacier. It would, however, be inexcusable not to welcome the monuments which now stare us in the face when they accord so perfectly with conclusions derived from evidence so independent in kind as are the organic remains. As to those who feel at liberty, as Von Buch and Elie de Beaumont have done, to call in catastrophes when they are at fault, it is very unlikely that the followers of that school will in our time admit the agency, whether of floating ice or of land glaciers, to the extent to which we ought now to admit them. Even they who have most faith in the adequacy of actual causes, will require to dwell on the testimony which I have just alluded to, the arctic fossils ranging south, and the ready growth of glaciers when favoured by slight changes of temperature, in order not to be staggered when they stand amidst the vines and the maize and the mulberry trees of the plains of the Po, and are called upon to believe that a lofty mound or ridge 2,000 feet high, called the Serra, running out into the great alluvial flat, is nothing but the left lateral moraine of an ancient glacier. That it is so, I am now fully convinced.

I had asked Escher whether he knew any sections in Switzerland in which either the ancient or recent moraines exhibited that singularly contorted arrangement of the beds of clay, gravel, and sand, which they display in Forfarshire or in the mud cliffs of Norfolk. He told me it was so rare to see a fresh section, that he could not give a satisfactory answer to my question. Now it so happened that a railway is making from Turin to Ivrea, and although they cut through the lowest part of the terminal moraine near Mazzi, they have thought it worth while to make a tunnel through which we walked. Near the entrance I was delighted to see that curious folding of the strata which will cause the same beds to be twice pierced by a perpendicular shaft, yet with-

out the beds below having participated in the movement. I have elsewhere speculated on the cause. What I feel to be important is, that here as in England, when erratics and unstratified mud are in association with stratified materials, the latter are liable to be twisted or folded in so extraordinary a manner.

In order to appreciate the distinctive character of this colossal moraine, you must reflect on the uniformity and evenness of the vast plain of the Po all round it, for although really inclined from the Alps, it looks as level as the sea; then fancy the great mounds sloping up at angles of 20° and 30° to heights of 500, 1,000, 1,500 and 2,000 feet; then consider that at the very extremity, as near Caluso, there are blocks of protogine which have come 100 miles from Mont Blanc; also that the whole assemblage of stones is not like that which has issued from the Susa or from any other valley, but confined to rocks such as now strictly belong to the basin of the Dora Baltea; also that the pebbles and fragments of stone, if of serpentine or any easily striable rock, are all striated, at least nineteen-twentieths of the whole, whereas in a recent glacier which has only travelled ten miles, you might only find one in twenty of the same stone striated; and lastly, think of the narrow vomitory which has disgorged this enormous quantity of material, the ravine above Ivrea being as obviously the source of the whole, as is the crater of Vesuvius the point from which its lavas have issued. When Gastaldi read his paper to the Geological Society at Paris, written jointly by him and Martens, Elie de Beaumont, who had many years before visited the ground, objected entirely to their conclusion that it was a moraine, but I never saw a stronger or more satisfactory case. But in the same paper the authors hazarded an opinion that although the old Alpine moraines stopped short after going a few leagues from the Alps, yet at some former time erratics had been conveyed to the summit of the Collina just as 'Pierre à bot' and other blocks had been carried by the old Rhone Glacier to the flanks of the Jura. Now when I read this at Zürich, I immediately recollected that in the valley of the Bormida when I passed from Savona to Alessandria in 1828, I had been astonished at some very huge erratics of serpentine in

the Miocene. Having never seen blocks of such enormous dimensions in any tertiary formation, I was relieved in 1828 at finding in some spots on the Bormida projecting fragments of serpentine in place, which the erosion of the valleys had exposed to view. I concluded that they may not have travelled far, and when I saw some large blocks on the Superga (in 1828) I immediately suspected that as that hill consisted of beds of the same formation, the blocks might have been washed out of the Miocene not far off. I therefore now suggested this view to Gastaldi, and found that he was by no means tenacious of his printed theory, although he said that the blocks were many of them angular, of very great size, and accompanied by Alpine loam. We then examined the beds of the Superga, both those dipping to the NW. and those to the SE., and on both sides of this anticlinal are strata containing fragments of stone of various kinds, some not known in the neighbouring Alps or Apennines, from two to eight feet in diameter. On our ascent to the Superga I saw a thickness of sixty feet regularly stratified of this conglomerate, in which were fragments consisting chiefly of serpentine, but some of limestone, others of protogine granite, and one of the latter angular and eight feet in diameter. In less than half an hour's search, I found two of the serpentine and one of the limestone pebbles with scratches, which would be called glacial if they were found in a modern moraine, though not such as you would select for examples for a museum. Still I searched this year in some recent moraines quite as long without finding better. As to the age of the beds, there is no doubt of their belonging to the Lower Miocene, the marine fossils of which we collected in strata both below and above them. These enormous blocks therefore were brought into their present position by causes which acted in the Miocene sea. I know of no agency but that of ice which could have quietly let them down upon subjacent beds of undisturbed fine marl and sand. Hence I conclude that there was floating ice in the Lower Miocene period, and if the few scratches I saw really imply glacial striation, the ice-rafts are probably derived from glaciers which came down from mountains bordering the Glacial sea; perhaps from the Alps, for that chain must

have existed before the origin of a large part of the Lower Miocene. I have kept the specimens I found of these Miocene striated stones to show Ramsay, who will be interested in hearing, that in spite of some Brazilian genera of trees and insects, and not a few palms, and some reptiles of good size, and many other fossil genera found on both sides of the Alps and supposed to imply a subtropical climate, I am not afraid to appeal to ice as the only known cause capable of stratifying these great masses in the manner in which they occur. I am sure that in the basins of the Tanaro and Bormida there are some rocks of the same age very much larger than any I have seen. Professor Angelo Sismonda was absent from Turin with the Princes of Sardinia, who I hope will become good patrons of geology. His brother the paleontologist showed me every attention.

I hope to find time before reaching Florence to tell you of some other geological matters which occupied me at Turin, and of several things seen in Switzerland not yet alluded to.

Signor Cocchi writes to say he is expecting me at La Spezzia, where I also learn that there are two active young geologists, the Marquis Doria and Signor Campanelli.

Believe me ever most affectionately yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

Ruta, Riviera di Levante: September 25, 1857.

My dear Horner,—We are stopping to dine half way between Genoa and Sestri, having followed the beautiful road which skirts the Mediterranean among groves of olives and figs, and admiring in the gardens of the numerous villas orange trees which stand the winter, and oleanders of large size. Here and there the *Pinus maritima*, with its foliage brighter than that of most pines, and some chestnuts varied the scene. There are many hedgerows entirely made of aloes, and we saw some cactus, reminding us, as did much of the vegetation and the steep rocks and the trellised vines, of Madeira. We only saw one date palm, but that also helped the resemblance. The rocks however are not, like Madeira, volcanic, but composed of what the Swiss call 'flysch' and

the Italians 'macigno,' a formation of vast thickness and without fossils, except a few fucoids. I mentioned it in my letters to you last year as being styled at Vienna the 'Wiener sandstein.'

It has had the singular fate of having been classed during the progress of geology under the head of every great division of strata—transition, secondary, tertiary, and is now quite proved by Escher and others to be above the nummulitic Eocene.

I have been seeing this flysch in my Swiss tour (in the Vallais among other places), and always with great interest, not only because its roofing slates look so very ancient, but because the extreme scarcity and general dearth of fossils, even where it is not in a metamorphic state, is so singular in a rock of this age. It encloses near Genoa some mountainous masses of pure dolomitic limestone which have also proved as yet unfossiliferous.

There is I suppose no doubt that Hannibal with his African elephants crossed the Alps, though so many essays have been written to decide by which pass they got over. Dr. Falconer has very properly started another question, whether the Siberian elephant ever performed the same feat long before. He found all the specimens in the museum of Italy to which the name of *El. primigenius* was affixed, to belong to two or three other species distinct from the mammoth, and therefore when he at last reached Turin and discovered that they had made the same error in regard to several of their proboscidians found in a railway cutting, he not only corrected their nomenclature and put the names of *E. antiquus* and *E. meridionalis* as substitutes for their *E. primigenius*, but also when he met with a real tooth of the last-mentioned species (or mammoth) he put a query as to whether it was really a true Piedmontese fossil.

When I had quite convinced myself that large glaciers had once advanced many leagues from the Alps into the plains of the Po, I felt sure that a cold climate must once have prevailed in the highest bed of the railway cutting which I only saw as I passed in the train, but of which Gastaldi gave me the details. The *marmot* has been found, the skull very entire, and not distinguishable from the living

Alpine animal. As I had seen in the present tour no less than four individuals of this species which Dr. Debey had procured from the loëss at Aix-la-Chapelle, and another which Mr. Morlot got from an old moraine near Lausanne, the discovery of this creature in the plains of the Po some miles in advance of the terminal moraines of the old southern subalpine glaciers seemed to me to render it probable that the mammoth might also have availed himself of the same cold climate, and at least have extended his range as far south as the marmot. Falconer had, I am aware, expressed himself with due caution as to the opinion that the *E. primigenius* had never crossed the great chain, since he was merely led to suspect it from negative evidence. But I expect that the mammoth will be the rare exception in Italy, and the same heat which melted the glaciers, vast as they were, and caused them to terminate so abruptly in the great plain to the north of the Po, checked also the southward migration of the hairy northern elephant. At any rate the publication of Falconer's paper will lead to the speedy clearing up of this question.

I had often heard that the old glacier moraines of Switzerland had left some curious monuments of their ancient extent in places where they have in great part wasted away under the influence of fluvial and torrential action, and I had planned last year a visit to the celebrated 'pyramids of Botzen' in the Tyrol, which I presume exhibit this phenomenon. Having been unable to accomplish that point when I went through the Styrian Alps, I was not a little pleased to meet with others which fell in my way this year.

The first column which we saw, called the Dwarf's Tower (or in the *patois* of Vallais, Zwerglethurm) was near Viesch, in a small tributary valley which joins the great valley of the Rhone. It is a single isolated pillar no less than thirty-five feet high, of sandy mud, such as one sees in every moraine—fine mud with sharp sand and angular pieces of various rocks scattered irregularly through the paste, and now and then a larger rock stuck into the same without any arrangement or stratification. Now and then some of the small pieces of granite, gneiss, or quartz were somewhat rounded. At the

top are two large blocks which have evidently protected the mass below (which is about seven feet in diameter) from pluvial action. About 100 feet higher up the same steep slope of mica-schist covered with fir trees is a second column about twenty-two feet high, but with a much larger block on its top, and there are no others in the neighbourhood.

They are monuments of the complete removal by rain and by the melting snow of what was probably an old moraine. At any rate I saw similar columns afterwards, some of them formed, others in the act of growth, at Stalden in the valley of the Visp, which joins the Rhone from the south. I measured and made drawings of them, and found them to contain erratics of various rocks, which could not have fallen down from the rocks above like a talus, besides pebbles of serpentine with glacial striæ. Unfortunately the Stalden pillars have some of them lost their cappings of large erratics during the late earthquake of 1855, which did so much damage to the town of Visp as well as to Brieg, and which caused landslips and the fall of rocky masses from the precipices bounding the Visp-thal. These same earthquakes, by the way, may explain the origin of some of the gigantic masses which, falling on the old glaciers of the glacial period, were carried for more than a hundred miles into the lower country.

James Forbes has well compared such pillars as the Dwarf's Tower to the portions of earth or stone which the workmen often leave to test the quantity which they have removed. Old Time seems to have resolved to leave us now and then a monument of the same kind, without which, in such a case as the two pillars near Viesch, we should never have given him credit for the extraordinary volume of matter he has slowly and quietly carried away. At Stalden we should have been able by observing here and there solid fragments of the old moraine 800 feet or more above the valley-plain to infer a once continuous mass, but I saw nothing of the case near Viesch. There are many gorges in the Alpine valleys from which the old glacier moraines have been quite cleared out by the torrent, the rain, and the melting snow, the same moraines being in great force above and below the gorges. Just as in Auvergne, one finds a

stream of lava like that of Tartaret, above Neschers, which has been entirely swept away in the course of ages and the valley deepened in the granite or other rock which formed the defile, while above and below where the valley widens, you see a continuous flat-topped current on one or both sides of the river, with its range of basaltic columns below and its scoriæ above. It is the comparatively small quantity of old moraine adhering to the sides of the Alpine gorges just above where the old glaciers entered the plains of the Po which makes the extraordinary expansion of the moraines just below the outlets or embouchures of the same old glaciers so striking. But it is clear that the same torrent, which has such unlimited erosive power when rolling down a steep descent within the Alps, would have little in comparison when it came out into the plains of the Po. It would make many breaches, as it has done in the great semicircular moraine, but it cannot destroy any of its prominent features.

Ever most affectionately,

CHARLES LYELL.

To HIS SISTER.

Florence: October 4, 1857.

Dearest Marianne,—It is wonderful to think that it should be thirty-nine years since I was here for the first time with you and Fanny, for that visit seems to me as recent or more so than many things which have happened not half so long ago. It was the year before that only, that Mary's uncle, Francis Horner, died, whose marble tomb, with the medallion executed by Chantrey, we went to see at Leghorn on Thursday, in the Protestant cemetery, surrounded by China roses in full bloom and half hid by oleanders, which the custode told us were full of flowers for the earlier part of the summer. It was evident that that monument, and the one to Smollett, who was also buried there, are the lions of the place, as the woman who shows it did not know who we were, and selected them. Mary went also at Pisa with me to see the room where her uncle died, which happened to be unoccupied.

It was a great treat to us at this same Pisa, to receive

your long letter about the four bairns whose different characters you have so well described. We cannot be thankful enough that Harry[1] and his family were safe out of India before this fearful insurrection began. When one thinks of the warnings of Mountstuart Elphinstone, Sir Thomas Munro, and above all Sir Charles Napier, and his words about 'caste being another name for mutiny,' one cannot but feel indignant at the supineness and apathy with which all ordinary precautions were neglected at Calcutta, and at home.

I have much enjoyed the geology of the Pisan Hills, a beautiful country. As the Professor of Geology, Savi, was not quite well, and only able to show me the museum, he sent an assistant with me who knew not a word of any language but Italian. I was well pleased to find that I could converse with him the whole day without fatigue, and I only wish I could say the same of my German, which I look upon as about four times as difficult to one who starts with English, French, and Latin. I find a good deal of scientific activity in Italy, so far as I have gone, especially in Piedmont. We saw the Somervilles yesterday; considering that she is seventy-eight, and he a good many years older, they are marvellously well. Both her books are requiring new editions in England, her 'Geography,' and the 'Connection of the Sciences.'

We have taken our places in a large steamer which sails direct from Leghorn to Messina, only touching a few hours at Civita Vecchia (for Rome), and at Naples, and then going on to the East.

Believe me ever your affectionate brother,

CHARLES LYELL.

To GEORGE HARTUNG, ESQ.

Naples: October 16, 1857.

My dear Hartung,—I was very glad to receive your letter. I have already seen much in this neighbourhood; above all, several streams of lava in motion, some going fast, others very slow, and they have given me many new ideas. The manner in which they cling to a slope of 27°

[1] His brother, Colonel Lyell.

is very striking, and they cover *continuously* an immense area, one-half of the whole cone in five and a half months, by always flowing between preceding currents. All the currents described by Scacchi of 1850–1855 are overwhelmed, the prismatic lava of 1855 concealed under new torrents which are as steep, but perhaps not so un-vesicular.

As to the walls of Somma, so far as I have yet re-examined them, they offer no difficulty whatever. They are simply thin-bedded lavas, rarely very continuous, alternating with dense beds of coarse tuff and lapilli and coarse conglomerates, at an angle of 27°.

I begin seriously to doubt whether any of the rents, which are now dikes, imply distension as De Beaumont assumes. Scacchi's observations seem to show that they are rather the effect of a failure of support, and attended with a partial sinking. But I will explain more when I have devoted more days to the examination of this region.

I believe from what I am now seeing, and what I recollect of Etna, I shall be able a month hence to tell you that here in the Kingdom of the Two Sicilies, as in Madeira, when the beds are highly inclined they are thin bedded, one or two or five feet thick, and where the inclination is slight, as five or six degrees, they are often very thick, twenty and fifty feet thick.

I have been delayed here by the extreme irregularity of Neapolitan steamers, and shall not reach Etna for six days. There is, I hear, a small eruption going on there. I am glad of it, for I am now sure that no one can describe lava flowing so as fully to make others understand it. I assure you I scarcely expected to find so much confirmation in a few days of the upbuilding, as contrasted with the upheaval theory. Scacchi is my companion, and a scholar of his, Guiscardi. I do not believe that Scacchi would allow that one-fourth of the inclination in Madeira could with any probability be attributed to upheaval. But all that we say is, that this is the maximum of what may be. We do not say it must have been. All the movement here is bodily, as you say of the Azores.

Believe me ever most truly yours,

CHARLES LYELL.

Lady Lyell desires her kindest regards, and begs me to say she is sorry you are not with us. So am I, but every day makes me feel that you would only have been confirmed in the true doctrines, which you have gradually and not hastily embraced. I shall claim you as the first of my pupils in the volcanic line, and you will soon have seen more than I have, at the rate you proceed.

To His Sister-in-Law, Miss Susan Horner.

Avignon: December 19, 1857.

Dearest Susan,—I do not wonder that you were so charmed with Rome. It certainly combines a greater variety of attractions than any place. The sculpture struck me more than ever. As to the antiquities, much has been done since my preceding visit more than a quarter of a century before. The catacombs I never heard of when I first went there. If half a million were buried in this way for five centuries or more, the number would of course be immense, and after all, if they used the volcanic tuff for pozzolana, I can fancy its being a cheaper form of burial than ours, as the room required for the mere body in a winding-sheet was so much less than for a coffin, and the volcanic matter removed worth something.

The circus of Romulus Maxentius, entirely discovered and disclosed since I was last there, is a very grand monument of antiquity. I was also much pleased with the theatre of Tusculum, and what little I could see of the amphitheatre. The Alban Lake, also, which I went all round for geological purposes, and the sight of Old Alba. Within the walls also of Rome, much has been done to display the antiquities.

The geology of the Campagna, and especially of the Latin Hills and Hannibal's Camp, is very instructive, and there also one falls in with all kinds of Roman antiquities which Ponza explained to us. There is, moreover, a singular advantage which I did not appreciate before in the Campagna, arising from its being so unhealthy in summer and autumn, that they can only get good rents by leaving it in a pastoral condition. By this means one has a boundless space almost in a state of nature, close to a great centre of the arts and

of antiquities, and where there is much agreeable society brought near together, and in a way to promote much social intercourse, with good things to talk about. All the naturalists expatiated to me on the beauty of the wild flowers in spring. I saw some, and several butterflies even in November. What a charm there is in seeing no hedges and fences, and straight ditches and ploughed fields! As a woman said to us, who after settling in Nova Scotia for seven years, returned to pay a visit to Manchester (?), 'I am truly sorry for people who are obliged to live where they cannot move a yard out of a straight turnpike road without committing a trespass.' There is some compensation, therefore, even in the malaria. Menighini of Pisa endeavoured to account for the increase of this pest since the Augustan age by the gradual sinking down of the west coast, which has submerged a considerable tract, and sent the aguish air of the marshes up the Tiber and other rivers. I had heard so many theories before, that I was surprised they were not exhausted, and this seems more likely than most of them, if the subsidence be as certain as he affirms.

The weather during four days' excursions into the Pisan Hills, and the hills between Volterra and Siena, was most delightful; the air so clear, the sky so blue, and the sun, though in December, so genial. The vegetation in those parts not monopolised by the olives was sufficiently unlike our own to interest me. Evergreen oaks, with an undergrowth of an evergreen called *Cytisus salicifolia*, and the *Cratægus pyracanthus*, which we have introduced so much, and a heath almost as high as *Erica arborea*, but what they call by another name. On some hills we had zones of olives, chestnuts, and pines, one above the other.

I forgot to tell you that Mr. Gibson inquired much after you, and paid handsome compliments to your skill in modelling. Miss Hosmer has bought a new spirited horse. Gibson told her it would throw her, but she said she should ride it for all that. He says she has great perseverance, and works very steadily. Gibson wanted an account of his allegorical sculptures, which accompany his statue of the Duke of Wellington, to be printed in an Italian periodical, but the censor actually struck out the description of the

angel carrying the Duke's soul up to heaven, as this was impossible, seeing that he was a heretic. Gibson has kept the proofs with the censor's erasures, and certainly they are a curiosity in the year 1857. He told us the story in sight of the new column raised to the Immaculate Conception, and with this in the background, no open display of superstition ought to astonish one.

Considering that no lectures on geology are authorised in the Sapienza, I was amused at the late French ambassador Count de Rayneval having made a splendid collection of tertiary fossils in the hill of the Vatican, which he and Ponza are preparing for publication. They are curious, and intermediate it seems between Miocene and Pliocene. For five years they have worked away under the Pope's window, to throw light on the earth's antiquity.

We hope to see you now in a week or ten days.

Ever yours affectionately,

CHARLES LYELL.

CHAPTER XXXII.

JANUARY 1858–SEPTEMBER 1858.

INDIAN MUTINY—DINNER AT MILMAN'S—SIR HENRY HOLLAND—RAJAH BROOKE—BUCKLE'S 'HISTORY OF CIVILISATION'—DEATH OF DR. FLEMING—MEETING AT THE GEOLOGICAL SOCIETY—DEATH OF ROBERT BROWN—LAC DE BOURGET—POLITICS WITH SIGNOR BEZZI—NAPLES—EXPEDITION TO VESUVIUS—FESTA—MESSINA—CATANIA.

[After spending some weeks of the summer of 1858 with his brother's family in the Berg Strasse near Darmstadt, gastric fever attacked his young nephews, and leaving his wife with the then convalescent patients, Sir Charles set off at the end of August on a tour to revisit Vesuvius and Etna, the result of which was an important paper on the 'Origin of Mount Etna and on the Theory of Craters of Elevation,' which was read at the Royal Society. Large extracts from Sir Charles's Journal, addressed to his wife, are given in the following pages. The Copley Medal,[1] the highest reward of the Royal Society, was conferred on Sir Charles Lyell this year.]

CORRESPONDENCE.

To GEORGE TICKNOR, ESQ.

'53 Harley Street, London: January 23, 1858.

My dear Ticknor,—It is so long since we have had any direct correspondence, that I shall write you a short letter, and beg for some account of your present occupations beyond what I gain from the interesting letters which Mrs. Ticknor and Anna have sent, and what the newspapers told us of

[1] 'Nie ist wohl die Copley Medal einem Werke gewidmet worden, das zur Verbreitung und Vervollkomnung einer Wissenschaft heilsamer gewesen ist, als den schönen "Principles of Geology" unsers edlen Freundes Sir Charles Lyell.'—Extract of a letter from Baron von Humboldt to Madame Pertz, early in 1859.

the opening of the Boston Library, and your part in that affair, in which we know from other sources how much you have done. It was fortunate for us, as we could have done no good if here, to be engaged on a tour on the Continent, when the horrors of the Indian mutiny and the anxieties of the commercial crisis were agitating people's minds all over England.

My tour was unusually profitable, first in the glaciers and then the volcanos. I came to the conclusion that Agassiz, Guyot, and others are right in attributing a great extension to the ancient Alpine glaciers, and that floating ice which I believe has done much in Great Britain, Scandinavia, and the United States will not aid, as I formerly suspected, in explaining the transfer of Alpine erratics to the Jura. I found Agassiz's map of the Zermatt glaciers and moraines very correct and useful.

We dined with the Milmans yesterday, both very well; their three sons also. We met Macaulay (the new peer), looking rather older, and with a baddish cold and cough, but cheerful, and telling many a good story; the Chancellor, and Lady Cranworth, both looking in good health; the Monteagles, Sir Henry Holland, who had been far, as usual, in a short time, among other places at Jerusalem, and in sight of the Pyramids. I think you saw when here the Herman Merivales. We dined there last week, and met among other public characters, Rajah Brooke of Borneo. He told me that nearly all the Malays could read and write, and might be rapidly improved if they had better things to read, but the Methodist and other missionaries will only translate into the Malay language things which neither they nor he (i.e. neither the Malays nor Rajah Brooke) cared to read. What would you recommend them to give them instead? 'I would begin with the "Arabian Nights' Entertainments."'

We have just voted at the Royal Society 150*l.* to Mr. Mallet, an engineer and geologist, who has offered to go and collect physical facts relating to the great earthquake south of Naples. I have had him with me half the morning, and expect he will do us good service.

Have you seen Mr. Buckle's book, 'History of Civilisation in England'? I have just bought it--full of talent, and

having the great merit of setting people thinking. I am prepared to find paradoxes and contradictions, as I did in the conversation of the man himself, but you will do well to get it for yourself and your Library as soon as you can. That large party here who exert a severe censorship on all who dare to think differently from the 'endowed doctrines,' as Channing called them, are up in arms, and threaten to blackball the author at the Athenæum, but I hope they will fail, or that the committee will elect him before the ballot. For so bold a book, it is having a considerable sale.

Ever most truly yours,

CHARLES LYELL.

To J. W. DAWSON, ESQ.

53 Harley Street, London : February 14, 1858.

Dear Dawson,—Dr. Fleming's loss was very sudden and unexpected by me. Less than two and a half years ago, Hugh Miller and Fleming accompanied me severally on many excursions about Edinburgh. Miller was the extinction of a great light who was making steady progress, and daring to declare his faith as he went on.

I spent more than two months in the glaciers of Switzerland (last autumn) and came to the opinion that the transportation of all the blocks in the Swiss valleys, and between the Alps and Jura, and on the Jura, and also on the plains of the Po, was effected without the agency of the sea. Agassiz, Guyot, and some who went before, were, I think, right in this. I found all the glaciers advancing from year to year.

I then went to Naples and Catania, and re-examined Vesuvius, which was in full activity, and Etna, the latter much altered, especially in the Val del Bove, since I was there in 1828.

My convictions derived from my first visits in favour of the origin of those mountains from a series of eruptions, and against the Von Buchian theory of Elevation Craters, have been fully confirmed. I am writing a paper for the Royal Society on the subject.

We are getting on well at the Geological.

It will indeed be a great point for you if Sir Edmund Head and the Government settle at Montreal.

Believe me ever most truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

London: March 12, 1858.

My dear Horner,—Mary has written a journal of our proceedings to you, and I shall merely add a few words about the last meeting of the Geological Society, when Darwin read a paper on the 'Connection of Volcanic Phenomena and Elevation of Mountain Chains,' in support of my heretical doctrines; he opened upon De la Bêche, Phillips, and others (for Greenough was absent) his whole battery of the earthquakes and volcanos of the Andes, and argued that spaces at least a thousand miles long were simultaneously subject to earthquakes and volcanic eruptions, and that the elevation of the whole Pampas, Patagonia, &c., all depended on a common cause—also that the greater the contortions of strata in a mountain chain, the smaller must have been each separate and individual movement of that long series which was necessary to upheave the chain.

Phillips pronounced a panegyric upon the 'Principles of Geology,' and although he still differed, thought the actual cause doctrine had been so well put, that it had advanced the science, and formed a date or era, and that for centuries the two opposite doctrines would divide geologists, some contending for greater pristine forces, others satisfied like Lyell and Darwin with the same intensity as Nature now employs. Fitton quizzed Phillips a little for the warmth of his eulogy, saying that he and others who had Lyell always with them, were in the habit of admiring and quarrelling with him every day, as one might do with a sister or cousin, whom one would only kiss and embrace fervently after a long absence. This seemed to be Mr. Phillips's case—coming up occasionally from the provinces. Fitton then finished this drollery by charging me with not having done justice to Hutton, who he said was for gradual elevation. I replied that most of the critics had attacked me for overrating Hutton, and that Playfair understood him as I did. Whewell concluded by consider-

ing Hopkins's mathematical calculations, to which Darwin had often referred, in reference to D.'s theory. He also said that we ought not to try and make out what Hutton *would* have taught and thought, if he had known the facts which we now know. I was much struck with the different tone in which my gradual causes were treated by all, even including De la Bêche, from that which they experienced in the same room four years ago, when Buckland, De la Bêche, Sedgwick, Whewell, and some others treated them with as much ridicule as was consistent with politeness in my presence.

Yours affectionately,

CHARLES LYELL.

To GEORGE HARTUNG, ESQ.

53 Harley Street, London: March 22, 1858.

Dear Hartung,—I have had a letter from Mr. Wollaston, who is now in Teneriffe with Mr. Lowe, formerly of Madeira, and who is now collecting plants while Wollaston collects Coleoptera in the Canaries. For six weeks they had the loan of a friend's yacht, and went to Hierro and Gomera, spending some time in exploring each entomologically and botanically; but I am sorry to say neglecting the shells except when they obtruded themselves on their attention. Wollaston says, however, they got some thirty species, mostly different specifically from those of Madeira. The weather having become more genial, they took Teneriffe in hand, and mean next to go to 'the wooded caldera of Palma,' where Wollaston expects to get plenty of beetles. He speaks with great admiration of the native and uninjured forests of Hierro, but with much disappointment of the cleared country of the valley of Tarro.

Not a word about geology; but Prof. Piazzi Smyth has just returned from an astronomical tour in Teneriffe, and published a book upon it, in which there are geological observations scattered here and there. He and his wife encamped some 9,000 feet high on the peak, or rather got the sailors of the vessel which took them out, to build a rough shelter with blocks of lava.

I am getting on with my reading up for my paper on

'Etna,' a course of reading which will be useful for Madeira. I find that Waltershausen imagines almost all the stony beds which you and I should consider as lavas, and which are *parallel* to the tuffs and scoriæ, to be injected in the form of dikes! By this means he obtains proof of great upheaval. But he is against any great catastrophe, and goes to work as patiently as I do. Pray let me know what you are studying and reading and writing. As to upheaval on Etna, I saw very few beds which required it, and what we allowed as possible for Madeira, or one-fourth of the whole, is the utmost which is wanted, or probable in any part of Etna.

Ever faithfully yours,

CHARLES LYELL.

To GEORGE HARTUNG, ESQ.

53 Harley Street, London: April 22, 1858.

My dear Hartung,—I was glad to hear that you had observed in the Azores those mica-schist and other fragments, which I believe will turn out to have been transported by ice. But you would have followed it up with more spirit, and traced them to their maximum height, had you thought of the glacial theory when there. Icebergs get as far south in mid-Atlantic in our time, and if so, thousands of them may have floated there annually in the old glacial period.

Our present schemes for the summer are still somewhat vague, but probably we shall leave this in July for some place on the Rhine near Heidelberg or Darmstadt. I should like you to join me, that I may go over the MS., especially the illustrations of our joint paper or papers on volcanic subjects. I also hope to get to Zürich and Berne in the course of the autumn, and see Heer, Escher, and the Swiss geologists, but nothing is yet fixed. As soon as I have got off my hands what I have to say on Etna and Vesuvius, I shall return with more knowledge to Madeira and the Canaries. I mean to allow some upheaval in case of Etna, but exceedingly subordinate in proportion. So also in the case of Vesuvius. Scacchi and some of the best observers in Italy doubt whether *any* is absolutely necessary in the case of Vesuvius. A few local and partial dislocations may of course

happen, and you may find beds vertical, but such accidents are more likely to derange the symmetry of cones than to be the cause of that symmetry. But I will not allow the extravagance of the ultra-upheavalists who call Monte Nuovo a case of *erhebung*, to provoke me into a denial that there has probably been some central distension which has modified the more dominant influence of the outpouring of lava and the outthrow of scoriæ, &c.

Ever yours sincerely,

CHARLES LYELL.

To CHARLES BUNBURY, ESQ.

53 Harley Street, London: June 11, 1858.

My dear Bunbury,—I am sorry I have no specimen of *Equisetum Lyellii*, but I will inquire about it. I am glad you have taken up that subject, and hope you will publish on it separately—of capital mixed geologico-botanical interest.

Yesterday morning Robert Brown[2] breathed his last. They told him they might keep him alive even till Christmas possibly, Brodie, Bright, and Boott, by opium and stimulants, but he preferred not to live with a mind impaired, and so cheerfully and tranquilly, and in full possession of his intellect, gave way to the break up of nature. Every one who has been with him in his last days agrees with me in admiring the resignation with which he met his end, and the friendly way he talked and took leave of us all. Boott has been constantly with him, and looks much worn. Bennett sat up with him many nights,

I read my paper, or rather spoke it, last night at the Royal Society to a good audience.

Ever affectionately yours,

CHARLES LYELL.

[2] The eminent botanist.

JOURNAL.

To His Wife.

Basle: August 24, 1858.

My dearest Mary,—Between Bensheim and Heidelberg I found myself in a second class carriage, quite full; how they talk as contrasted with first class! It is the way to absorb German with a plentiful supply of tobacco smoke in one's lungs and clothes. At Heidelberg I took first class, a handsome saloon; nine others, all English, absolutely dumb, ladies and gentlemen. All turned out at Baden-Baden, and I was then alone to Basle. What a splendid panorama of the Rheinthal! I drew back all the blinds, and could walk about the room with Bach's map spread on the carpeted floor. No map is better coloured geologically for giving a pictorial idea of a large part of Europe to the eye of one accustomed to associate scenery with the nature of the rocks. You remember, some three years ago, I was discouraged by some of our Berlin geological friends from purchasing this valuable map, because they flattered themselves that Von Decken's, and the Geological Society of Berlin, would so soon come out with a better one, on as large a scale, and this is the third journey I have profited by it, and Waltershausen told me Von Decken's had not yet appeared.

The volcanic mass of the Kaiserstuhl stands out very prominently in the valley, and is well seen from the railway. The old Rhine, long after it was extinct, covered it by its annual inundations of mud, till it was nearly potted up in loess, and the modern Rhine has never been able, when it re-excavated the great valley, to wash it clean again. So it is blindfold work, as there are no continuous sections, merely a peep at the rocks here and there.

Culoz, near Perte du Rhone: August 26, 1858.—We have had a splendid drive from Geneva along the banks of the Rhone for some sixty miles. I should like to have seen the improvements in the town of Geneva, new streets, churches, hotels built since we were last there, but I hope some day, ere very long, that we may see them together.

The arch over the river called the Perte du Rhone exists

no longer; they have broken down the limestone arch under which the river flowed in a deep narrow gorge, in order to let the wood float down freely. This scenery is in the Jura where that chain joins the Alps. What with changes of railway carriages when the travellers for Lyons and for Italy divided, and the French douane first, and then the Sardinian, and a change to a steamer on the picturesque Lac de Bourget, surrounded by magnificent precipices of limestone, something in the style of the Saltzburg Alps, there were many opportunities of losing luggage. One lady's went wrong, another left a heavy purse in our carriage, but I got it restored to her. On the lake I fell in with Signor, now Cavaliere Bezzi, returning with despatches from London in two days, as lively and wide awake as if he had slept in a bed every night, and going to cross Mount Cenis without stopping, and to see Count Cavour on his arrival. He has been active in the Sardinian Parliament, and lives on his property on the Mount Ferrat (Superga chain) near Turin, has founded several schools, some infant ones, preached against by the clergy chiefly for founding them as a heretic and Protestant, and with such effect that he lost his seat, with many others, at the last election. Count Cavour offered to bring him in for a distant county, but he said he must in that case abandon all his schools and the superintendence of his private affairs, but next spring the Government has proposed his coming in for an adjoining county. Bezzi tells me, what I am sorry to hear, that all the old nobility are alienated from the constitutional system, because in 1849 primogeniture was abrogated, 'un fait accompli' which Cavour could not alter if he would.

I remarked, 'Now you will in the next generation have only two powers, the King and People; a republic or an absolute monarchy as in France, and as your people will not yet be advanced enough for the Republic, especially if you succeed in your desire to unite all Italians, most of whom will be less advanced than yourselves in politics, you will have the "Re netto."' He replied that 'nationality under an Italian sovereign would be worth having, even if they passed through a phase of absolute monarchy to gain it. If we could only get these foreigners out of Italy! There is only

one King towards whom there is any loyalty. All save King Bomba and the Pope are Germans. We wish your court had not German leanings.' I asked if he did not suspect that the concessions now offered to the Lombardo-Venetians by the Archduke Maximilian came from King Leopold's and Prince Albert's advice? 'Possibly so, for they are too enlightened to wish to see Italy governed as the Austrians would rule her, but still it is natural that your Prince Albert should not wish to see the Germans driven out.' He added, 'Palmerston when hard pressed by us to stand up for Italy on some point, coolly laid the blame on his court (!), saying, if I can have my way on important matters, I must yield in *small* ones, meaning by the latter the liberal cause or some point then under discussion, of Italy.'

I remarked, 'If an English minister who can easily control the court or resign, could be so unprincipled, why should you believe him? I think him at heart a man who sympathises with your enemies, whereas the Prince Consort is by nature a liberal. Do you not think that Palmerston and Clarendon were as free to act in the Cagliari affair, as afterwards Lords Derby and Malmesbury? The German leanings alleged against our court did not interfere there, and yet you see which side they took.'

To this Bezzi replied, 'Well, it may be your aristocracy as much or more than the court; all we Italians know is this, that hitherto all your diplomacy has been Austrian to the backbone in every part of Italy except Turin. Sir J. Hudson alone has been true to us, a man of enlarged views and a good heart.' I told Bezzi how openly the French press avowed that the union of all Italy into a compact nation would diminish French power and influence, and although the French and Austrians may by their mutual jealousy preserve Sardinia independent, they would never allow a revolution which should consolidate Italy and make her free. So may it not be best for the Lombardo-Venetians to accept from the Coburgs such concessions as the two rival despotisms would never grant? 'My dear sir, it is all too late—the anti-German feeling has become a sentiment throughout the best heads and hearts in Italy.' He then told me that

Savoy was a source of political weakness to Sardinia, because they did not speak Italian, and were superstitious. They refused to furnish one soldier for the Crimean war, because it was against their principles! This was an act of rebellion, and some proposed to decimate them, but La Marmora said wisely that when a whole people (who are loyal to the King) were determined, you must wink at it, however awkward as a precedent. Even with Savoy they are only five millions.

Genoa.—It is lucky I came on, as otherwise I should have had to have gone by land to Leghorn, and then by sea direct by a Tuscan boat, as I shall do now, after a delay perhaps of several days which I can well employ, not by a run to Pisa or Florence, but by regular business, having much to prepare in going over my notes made when with Waltershausen, and studying them with the two maps of Etna, and planning each day's journey. You well know that once at Naples or at Catania there will be no time for this. Instead of a night of suffering I had my memory of the Alps refreshed, and even the least good of the Alpine passes exceeds all other scenery save Madeira, from which it is so different.

Leghorn, August 29, 1858.—We got here in about fourteen hours, in a small vessel only destined in ordinary times for La Spezzia. There was not much sea, and I scarcely suffered at all and slept most of the night, but numbers were ill, the small steamer rolled so much. I asked a young man whose appearance I took a fancy to, if he were English; he said no, and that he could not talk English. We went on in French; I saw he was German by his accent. I spoke out freely about the Neapolitan panic and ignorance (for Bezzi assures me it is not a political move) which has thrown the whole commercial world, French, English, and Italian, into confusion. He by no means dissented, but I saw both he and his wife smiled now and then, and he seemed a little cautious. Next day we had some more talk, and just now at the douane, I learnt that he was the reigning Duke of Saxe-Altenberg, travelling under an assumed name with his wife and a suite, one of whom lately married, and with his young bride, a pleasing girl, spoke English and talked much with me.

On reaching this about eight o'clock this morning, and

after getting through the douane, I found a splendid English three-mast steamer going to sail *to-morrow* straight for Naples, and not touching at Civita Vecchia. But the captain is waiting in no small tribulation for a telegraphic despatch which the Neapolitan consul expects to-morrow morning, and which may derange all his and my plans and those of many others—among them a very intelligent French agent of the Rothschilds who is in this hotel with me, and who having gone to Marseilles was put into the Lazzaretto here for four days, much to his astonishment and annoyance. For the Tuscan Government was persuaded by the Neapolitan, and the Pope, to put Leghorn into quarantine. But when this same Tuscan Government had learnt that Count Cavourfus had ered positively to inflict a quarantine on Genoa, Tuscany took courage and immediately took off the nuisance here. But now comes the danger; every one fears that in retaliation Naples may to-morrow morning put this port into the list of infected places, because she now trades freely with Genoa, &c.

Civita Vecchia: September 1, 1858.—It was rough and rolling weather when we started and many were ill, but I escaped, only went without eating till this morning when we got early to this port. I had a steady work at Leghorn, and was so rested after my march across the Alps that I can the better rough it in this steamer. The heat has not been oppressive, though of course the sun is powerful—yesterday it was cloudy. We have been five or six hours at Civita Vecchia, but I have not landed, as they talked of leaving sooner. It has enabled me to finish my notes on Mount Etna, and I shall now make a small list of essentials for Vesuvius, hoping to find Guiscardi at my service. I am told that September is thought a good month for Vesuvius, as later it is generally voted too cold.

Port of Naples: September 2.—We came here in about twenty-six hours from Civita Vecchia, the first part rough for a steamer of this size, the last half calm. So I arrive in good plight. A boat has come from Ungaro's, but it may be hours before I can profit by it, as you know how long the police are here. Vesuvius is capped with clouds, so I cannot

see how much vapour it is giving out of itself. No great heat as yet; rather pleasant temperature in this bay.

September 2, *one o'clock.*—Here we are after all our precautions, and in spite of a telegraphic message from Naples to Leghorn promising free entrance, put into quarantine for *one* day, as we are told. I profit by my cabin being to myself, and have a table in it with my books, and am working much as in Harley Street; weather cloudy and cool. Vesuvius nearly unrobed, and showing half way down between the summit and the base, or sea-coast, the new craters of 1857-58, smoking or fumeroling away. We are not to go to Nisita, but stay on board.

Ungaro has come himself in a boat, and tells me my letter arrived yesterday, and he sent it to Guiscardi. An order came to go to Nisita, but the captain pretended he had no coals left, so we are glad to be left opposite Vesuvius.

6 P.M.—Guiscardi has come in a boat, and had a long conversation, and will go with me to the Solfatara to-morrow. Ehrenberg is at Naples, and going soon to Vesuvius. Scacchi, Palmieri, and the others got my abstracts of Etna. All describe the eruption of last spring as most magnificent from Naples. I hope to get a small picture of it.

8 P.M.—We are lucky not to be in Nisita. One of the openings of April last is emitting a glowing light, sometimes brighter and then a dull red, rather lower than half way from the summit of the great cone. It gives us a good idea of the exact position of the last eruption, and of the wonderful escape the town below must have had.

As there is no moon, the lights of the houses all round the bay look brilliant, and the lateral crater's glow is a very distinct feature on the opposite side.

Naples: September 4, 1858.—I have paid an early visit this morning to the Temple of Serapis, and have found the brackish water incrustation on the walls which Babbage speaks of, and which I missed last year, and some points connected with it which I shall be glad to submit to Babbage for interpretation. I got back in time to attend a sitting of the Academy at eleven o'clock, when I saw Palmieri, who has given me a letter which I had requested from him

to admit me and Guiscardi to sleep in the Observatory on Monday.

Yesterday we visited (Guiscardi and I) the crater of the Solfatara, which is full of interest. The hot vapours rush out with a sound such as reminded me of the descriptions of the Geysers of Iceland. The extent to which the trachyte is turned into clay by the gases is curious, and often the felspar crystals have disappeared and left their forms in cavities while the felspathic base remains undecomposed.

To-morrow we go to St. Anastasia, to return at night to visit ravines or barrancos on the outer slope of Somma. Monday, to see the new mouth of April last, still in action, and sleep at the Observatory. Tuesday, Atrio del Cavallo and back. Wednesday, a great *fête*, of which more anon. Thursday, sail by a steamer direct to Messina, only, as it is Sicilian, will they keep their promise?

Many of the very baths which used to cure devotees in the pagan days of the Temple of Serapis are restored by slight repairs, and this after so long a submergence under the sea! I saw the hot spring there for the first time to-day.

September 7.—Just returned from a successful expedition to Vesuvius, which in the last three days I have explored in a variety of ways, and understand much better than before. The first day was to visit a ravine which runs up from the town of Somma, and which shows the structure of the mountain to be just like that seen in the great escarpment in the Atrio, except that there are no dikes.

Ehrenberg and Rammelsberg of Berlin were bent upon revisiting Vesuvius the next two days with us, and we offered them places in our carriage. We began with the Atrio. How glad I am you were there last year! I hardly think you could have got into it over the new lava of this year. Horses out of the question, and the fatigue considerable; no paths yet. A small cone stands in the Atrio just where we came down when we descended from the summit or great crater, and it sent a flood of lava over all the region which we crossed on horseback going from the Observatory. It flowed to the Fossa Vitrana.

Other small cones were formed at the base of the great

Vesuvian cone facing Naples, and though these are now dormant, and without even fumeroles, there is a constant emission of liquid matter going on from some unseen point or points below, above which are large swellings of lava, or gibbosities, as Guiscardi names them.

Palmieri believes that all the steam and gases are being let off by the great crater, which is sending out a grand body of vapour, forming in these sunny days bright and large fleecy clouds, while in every other direction there is only blue sky. He imagines that the lava is escaping from under one or both the gibbosities, without any steam or explosive gases, tranquilly welling out, and rising up through the mass of lavas. I walked in part, and was part of the way carried in a chair by four men, to a point where the lava was issuing from a small grotto, looking as fluid as water where it first issued, and moving at a pace which you would call rapid in a river. White hot at first, in a canal four or five feet broad, then red before it had got on a yard, then in a few feet beginning to be covered by a dark scum, which thickened fast and was carried along on the surface. You then saw this superficial scoriaceous covering forced by the current into a number of crescent-shaped ropy curves, evidently caused by the greater rapidity of the motion of the central part of the stream as compared to the sides; the ropes of scoriæ farthest from the grotto were the most perfect and solid. You would at first wonder that when the outer and exposed portion of the fluid cools and congeals, it does not begin to sink, but it is a peculiarity of liquid lava, that if you throw a stone on it and press it down, it will not sink. So the plastic crust of scoriaceous matter generated a few yards from the grotto cohered a few feet farther on, and at a few yards farther was converted into those bent cables which you saw last year on the lava of 1857 in the Atrio. All this manufacture of ropy scoriæ takes place in a minute or two. I could have watched it for an hour, but the heat which it radiated was so scorching that I could only take a glance by the help of the men holding their coats before my eyes. When I took up my eye-glass it was so hot I let go, though it was really not heated enough to require that.

I was exceedingly glad I undertook this excursion to the

top of the second gibbosity, from which Guiscardi rather dissuaded me on account of the fatigue, but few who are not residents at Naples ever see lava run away rapidly. We had also a fine opportunity lower down of watching the slow progress of lava, and saw the manner in which a small narrow ridge is formed. Possibly those described by me in the Val del Bove of 1852 were made in the same way on a gigantic scale. The viscous mass moves on, swelling out occasionally, with pieces of scoriæ rolling down in front and from the sides, which give way in such a manner as to undermine the top of the ridge, which continues solid, and by the undermining and falling away of both sides, acquire the shape of a sharp crest.

In the escarpment of the Atrio I tried to find the broadest of the ancient lavas, or a transverse section, showing how wide the widest of the old streams of Somma ever were. I could not get one above 200 feet, but this was only a rough measurement, and I hope Guiscardi will follow it up. If they are wider than one ever sees a stream on the flanks of the modern cone of Vesuvius, it may be used as an argument in favour of the upheaval theory, and therefore I was desirous of determining the point, which has been strangely neglected.

We finished yesterday, after coming down from the Observatory, with a drive all round more than half the outer circuit of Monte Somma, by St. Anastasia and the town of Somma to Ottajano, where we explored a ravine in which we were told there were dikes, but there are none; nor have I yet found one in the barrancos which radiate from the crest of Somma.

September 8.—I have had the Costas, father and son, to breakfast, *déjeuner à la fourchette* with tea and a bottle of Capri wine. The old man, after being three months in Calabria quite safe, was on his return knocked down by a common robber near Naples, and because he refused to give up his money, was stabbed in several places a few months ago. His purse was taken and he still shows in one eye the marks of the assassin, and is wounded in the leg, but full of spirit and energy.

I have had three days of such exertion that, although quite well, I am as glad of this repose to-day (though I have

to ticket innumerable specimens and pack my portmanteau), as the Neapolitans seem to be at the *fête* of the nativity of the Holy Virgin. The procession is to pass my window, which is on the first floor.

Half-past three o'clock.—For an hour and a half the troops have been passing my window; cavalry, infantry, and artillery; Neapolitans and the Swiss guard. The latter in red uniform like English. A fine-looking set of well-grown, and decidedly tall men. The numbers which have passed must be a great many thousands. Sometimes they went slow, but sometimes 800 infantry in one minute going as fast as they could. The cavalry managed 100 a minute trotting. Innumerable brass bands, which with drums seem to form nearly all the instrumental music; a great mistake, I think. The troops, after filing one way, are now forming an unbroken line, often four men deep, on each side of the street. Many carriages and foot-people crowd the interval between the ranks, and how the procession is to pass I cannot imagine. Such a repetition of regiments, without a mixture of civilians and priests, becomes monotonous when continued for two hours. I have been wishing that Katharine and the two boys were in my room now with you, dearest. At intervals I have been ticketing my specimens, and have nearly finished. Four men-of-war, one a steamer, and decked out gaily with flags, twenty or thirty on each mast, opposite my windows.

Four o'clock.—The cannon are firing to announce that the King has left his palace. The pavement is so covered with dust, that being never watered, it has caused some of the fine dressed troops to be a little dusty, and I see them wiping their coats. The cavalry raised clouds of dust when they moved fast.

The four ships of war are firing salutes one after the other, quite shaking the houses, though they are far enough off for a long interval between the rolling out of the smoke and the sound reaching us. The line of hills of Posilipo return a splendid echo to the guns. No end to carriages and six, and now one with eight horses, in which are the King and Queen, and glass windows very large. The people so excluded now, that I cannot judge of his reception, but per-

haps as it is the Virgin they are honouring, it is not a time for loyal demonstrations. The King is followed by some eight or ten six-horse carriages of state, with members of the royal family and officers of state, and several regiments of horse guards. We have now had three hours of a continuous military procession, and nothing else here at least.

The people are now closing in, and filling the middle part of the street, and seem very merry, but, for Neapolitans, not noisy.

Half-past five.—After an interlude at the *table d'hôte*, I return to my room, and find the fleet as busy as before, firing salutes. The troops still lining the streets. Some Englishmen at dinner tell me that they never heard the people make any more demonstrations of loyalty on other occasions. The priests seem to have been all in the churches, but one priest accompanied every regiment except the six Swiss ones, who, being Protestant, have none with them.

I am almost a prisoner, the streets being so lined with soldiery, and cannot help regretting that I never see Vesuvius, as every hour of the day the phenomena there are changing. They tell me the number of troops who have passed this window is just 22,000, and as they are all passing a second time, besides 100 guns, you may fancy the time they take. The infantry are actually running, and the cavalry trotting. The King and all the twenty or more carriages of state are gone by again, and the officers seem to be hurrying the men, who must be hungry enough. It is quite a curious sight to see the quick movement. All day opposite us have been thirty-two drummers and thirty trumpeters ; the former were allowed to overwhelm the others by their noise. Think of the cavalry having the old flint locks still. The Swiss at least have percussion guns. They have much higher pay, but are not allowed to be buried in consecrated ground!

This rapid retreat of the soldiers twenty-four deep across the street is a far more amusing sight than the outward march. We are now beginning the sixth hour of our uninterrupted military procession. The band has moved off, but others are passing and playing. Every now and then there comes a jam of people and soldiers, and a dead halt. The

Swiss are very conspicuous with their distinct costume, more than 6,000 Ungaro says.

September 9, *ten o'clock.*—I must leave this soon if I learn that the 'Etna' (steamer) is really true to her day and hour, which last is an unusual one, twelve o'clock. Guiscardi came to tell me last night that Vesuvius had given the required signs of sympathy with the two 'gibbosities' of lava which I before described. I went out with him between eight and nine o'clock, and saw light at intervals distinctly reflected from the vapours overhanging the highest crater, showing that there is lava there also. We now agree with Palmieri that the eruption is going on in the great chimney, but the lava is escaping *without* steam from the two cones *without* craters, which are just below the windows of the Observatory.

The lava was seen by us from the Observatory in the night, radiating in narrow streams from the upper part of the two flattened domes.

Guiscardi thinks I have made great progress this time in striking out a theory to explain the connection of the pumiceous tuffs of Monte Somma and the old lavas of the same mountain. If I have done so, it is partly because I had the means of taking expensive drives to distant points and back. Guiscardi had never reached Ottajano in his life. I have set him several supplementary observations to make, to complete points required by my theory.

Messina: September 10.—When I was concluding my last letter at Naples, Signor Scacchi came in and inquired after you, and we had an animated talk over what I had seen of Vesuvius during this last visit. We started at half-past three o'clock instead of twelve, and in place of bringing us direct to Messina, as promised in the advertisements, the 'Etna,' an appropriate name for my steamer on this occasion, took us to Reggio, and stayed two hours discharging cargo there, and then returned here, losing thus four hours of our time. So the post for delivery of letters was closed at twelve o'clock, and I must wait to see if there is one from Dr. Carlo Gemellaro to-morrow. After all we got here in twenty-two hours. No wind, but a roll from an old storm which made three-fourths of a large number of

passengers ill, but I escaped and was much amused by the conversation. All Sicilians or Neapolitans; some officers and their families returning from the procession to Our Lady of Pietra Grotta, i.e. the grotto of Posilipo, near which there is a chapel to which pilgrimages are made on September 8, and to which the royal devotee with his army go in state. There were also many priests and monks on their way back. A certain physician, young and lively, and known to many, was holding forth in our cabin, maintaining that the world of imagination and of ideas was the only thing real, true, and enduring, and all things material were fictions and a delusion, which of course he meant to provoke the others to combat. At last they came upon the 'Etna,' built last year in Glasgow, her machinery on quite a new construction, and having all her coal from Newcastle. They then appealed to Don Pietro, this learned 'medico,' to explain why there was so much coal in England, on which he went off in a more stately and exalted style than usual. 'The temperature of the English climate at a remote period in the history of our planet was ten degrees above that now prevailing in Sicily. There flourished at that time the vegetation which produced these dense strata of coal. Those plants were before the creation of animals, for it was necessary to establish plants first. Then came the herbivorous animals, afterwards the carnivorous, and lastly man was formed.' 'But, Don Pietro, you seem to require ages without end for all this.' 'Certainly, but it all admits of mathematical proof.' Some of the priests seemed intent on their breviaries, but perhaps they had one ear open to these new geological ideas, which have evidently been penetrating into those regions like Newcastle coal and Glasgow engines.

Messina, five o'clock P.M., 10*th*.—I have been a two hours' excursion up the course of a fiumara which runs from the hills here, with a pharmacien, Sequenza, and found two tertiary formations, Miocene and Pliocene, between the gneiss and the sea,—a very instructive section.

Catania, September 12.—After leaving my box of fossil leaves and rocks of Vesuvius at the British consul's, I went on board the 'Diligente' steamer at eight o'clock. The noise in the inn 'Victoria' so great, that I mean to try a new inn,

the 'Trinacria,' the rooms of which I inspected, kept by the former proprietor of the 'Victoria,' and near it. The 'Diligente' had come pretty full from Palermo, and the Catanians and Syracusans who had been at the great festa at Naples crowded into her. My commissioner had got me a good bed, but too late for a private cabin, as they were all secured at Palermo. The ladies' room crammed with women and children. The berths in the gentlemen's quite open, one over the other, not bad but public. After all were full, in came Il Barone and Baronessa, and two grown-up, lady-like daughters; no beds. One capitano after another got out and pressed the ladies to lie down on theirs. But they posted themselves in chairs with their backs to my berth, so I at least was a prisoner. Then came other ladies and gentlemen, all without beds. At last all the men gave up their berths to ladies they knew, and stood about, then got beds put on the great table and all over the floor. They contrived to give us plenty of air, and most fortunately, though the sea had been rolling for three days, the straits were as calm as a lake. In seven hours' sail we were in Catania, and not very long in getting ashore. The proprietor of this hotel came himself to help. I went to bed and learnt that no butter or milk could be had. Why not the milk of goats? 'Too late, and half-past seven o'clock; you can only buy between five and seven. It is too hot to have the goats later.'

I have been over the antiquities of Catania and examined some points in the lava of 1669 not seen last year, and had a talk with Gravina. The news came last night that Gemellaro's only daughter, aged thirty, the wife of a judge at Girgenti, was dead, leaving three children.

Calling at Tornabene's, I asked him if I should not find that Dr. Aradas could tell me all about the Gemellaros, and whether Gaetano would have to set out for Girgenti. He replied, 'I rather expect he will go, and you have no time to lose if you are determined to go to the Casa Inglese, and geologise the uppermost parts of the mountain. Go to-morrow; I will write to Dr. Giuseppe this evening.' So I am off.

Mr. Jeans has kindly lent me a beautiful hammock with which he has travelled all over Sicily, and a musquito net.

These creatures have been taking liberties with me again, after I had forgotten them since Leghorn. What a beautiful city this is, incomparably better built than Naples, something splendid in the style! One, Piazza Filippini, I had not seen,—all the columns from an old Basilica. The streets so wide, and the churches and private houses so often beautiful, and such a flood of light upon them. The elephant in the middle of the Piazza del Duomo is at this moment surrounded by a set of shrubs in full flower; a yellow one like a cytisus, a large red oleander, and others with white and blue flowers—very gay. I passed the Albergo dell' *Etna*, and that everlasting chime and bells of the church adjoining was making the usual stunning noise.

Dr. Giuseppe Gemellaro has spent 15*l.* since last year in repairing the Casa Inglese, so the 8*l.* I sent, with certain other subscriptions, will, I hope, cover this.

We have never seen the top of Etna since my arrival here, though the weather at Catania is splendid. Good night, dearest; just starting for Nicolosi.

Zafarana: September 15, 1858.—I am established here in my old quarters of nine months ago, and accompanied by Angelo, the guide of last year, who showed such resources in the Casa del Neve; which I find on Waltershausen's map is called Casa del Vescovo, and known here also by the same name. I yesterday drove to Nicolosi, seeing several things of interest on the road in the geological way. Found Dr. Giuseppe in affliction, especially as he was haunted with the idea that this blow might be the death of his brother. The necessity of making plans and preparations for my expedition with Waltershausen's map before me, and of getting provisions and guides, cheered him up considerably, and I left him less dejected and very busy preparing for my campaign in the Casa Inglese. To go there now, as I had hoped to do, is impossible, the weather is so unsettled; so I am to attack the middle heights of the Val del Bove first. The mornings are usually fine. I ascended the Monti Rossi yesterday; well worth doing, both for the crater and the scenery.

On my way here, a ride of four and a half hours, I found a new case of a stony lava on a slope of 10° and 15° and 29°, one of known date too, 1629. Also another lava with ridges

cut open, throwing some light on those of 1852. Just after we got housed here, there came on a very heavy thunder shower which may interfere with this evening's work and derange plans. I find I can get on with talking with the guides tolerably, and the map is an amazing help. I have three mules, and a muleteer who goes on foot, making with the guides three men. Dr. Giuseppe approved of my taking Mr. Jeans' hammock for the Casa Inglese. He fears that the property of the Duke of Ferdinandina in the Casa Inglese has lapsed to those who have built and repaired it, being so long unclaimed by the proprietor. I went to the valley of Calanna and did some good work, but was driven back by a soaking rain, but employed the afternoon well with the parish priest, Sciuto, who let me copy his rough map of the course of the lavas of 1852–3, and make extracts from the journal he kept when the great eruption was going on for seven or eight months.

Resolved that the weather was too unsettled for the upper regions, and that it is expedient to descend to the sea-side to-morrow.

Aci : Friday, 17.—Early in the morning Angelo, the tall guide, came to tell me that before dawn they saw a planet, quite a new one, with a long streak of light extending from it in the east. So I suppose a fine comet has appeared. The ride from Zafarana to Aci Reale was through endless lavas. When I got here I re-examined the highly inclined stony lava of the Scolazzi, all as I described it, but of course I learnt many new facts. I then went in a boat to see the basaltic columns of the Grotte delle Palombe. A small Fingal's cave, in a current of lava, where it enters the sea; a fine mass of scoriæ over the columns.

Nicolosi.—The weather has changed for the better, and as we rode out of Aci Reale, the whole of Etna, summit and all, appeared free from a cloud. The shape of the summit much more divided than when you saw it. This sight made me determine to wheel round and come here, to go up to the Casa Inglese to-morrow. When the master of the 'Aurora' at Aci saw us return, he exclaimed, 'I thought the gentleman would think twice before he left Aci the very day of the Festa della Vergine!' In fact the band was playing

in the streets as we went out, priests were assembling, and crowds of peasants in their best attire coming in to swell a population amounting, my guides say, to 30,000. But we rode resolutely through to the woody region, not sorry to be under a milder sun, though I have really never suffered from heat. I found Dr. Giuseppe quite prepared for my change of plan. He had sent up the bed this morning.

Nicolosi: *September* 19.—The clouds again return, and I am going to Biancavilla and Bronte in place of the Casa Inglese. By choosing my time I shall succeed at last, but the first fortnight of this month was perfect, and that I should have had according to my original plan.

Ever your very affectionate husband,

CHARLES LYELL.

CHAPTER XXXIII.

SEPTEMBER 1858–OCTOBER 1858.

ADERNO — PROCESSION OF MONKS — CASA INGLESE ON ETNA — ROUGH QUARTERS—VAL DEL BOVE—DESCENT OF THE BALZO DI TRIFOGLIETTO —COMET — FINE CLIMATE COMPENSATES FOR THE DRAWBACKS IN SICILY.

JOURNAL.

To His Wife,

Aderno: September 19, 1858.—My dearest Mary,—I must have a chat with you before I go to bed after a long ride from seven to five P.M; only off the mule when examining the basalts of Licodia and Biancavilla, often columnar and resting on a sandstone the age of which I have not yet made out. From Nicolosi to this place, through the woody region chiefly, was a fine lesson in the aspect of lavas of every age from one to eight centuries known, and for thousands of antecedent years of innumerable dates unsettled. I begin to have an eye for the coming on a new lava, where the difference would have escaped me one or two years ago. I had expected to sleep to-night in the Casa Inglese, but it has been so enveloped in dense clouds all day that we did right in desisting.

A procession is just passing, rather imposing; first fifty Franciscan monks two by two, each with a sort of Chinese lantern lighted, and on a short pole, preceded by drums beating in the usual Sicilian style of military devotion. Then comes a gilt splendid carriage, in which a figure of the Virgin, well done in the waxwork style and as large as life, stands upright; then a full military band playing, with soldiers attending; then an immense crowd of peasants.

There are also numerous banners preceding and at intervals, and fireworks and guns going off in the churches.

I think I shall soon be a good campaigner. Not liking tea and coffee without milk, and being tired of hearing of the impossibility of getting it, I ordered Giuseppe to get a clean empty bottle and a good cork. When we had been riding eight hours we came to a flock of goats, and I asked the goatherd for how much he would let me fill the bottle. He said one carline and a half—that the milk was good but not plentiful, and I should have to milk a good many of the flock. So Giuseppe set to work, and it took near half an hour (while I was geologising a cavern in the basalt) to fill the bottle with excellent milk, which I have been enjoying to-night, and shall to-morrow.

I never saw Etna look so grand as at four o'clock this afternoon. The cultivated region and the summit were in sunshine, and all the woody region concealed by a zone of fleecy clouds, above which it seemed marvellous to see a mountain. The sun was hot enough to make me hold an umbrella over my head, but this fatigue was relieved by an occasional cloud.

Nicolosi: 20.—Returned to this once more, that I may either go on with the Val del Bove or the summit, while the heat which is a little more than pleasant below, remains to cheer us above. I see clearly that after five months of very fine weather the time is come for Etna to be rarely fine for two whole days. But I have the great advantage of being here one month earlier than when I encountered the snow-storm last year. Dr. Giuseppe was glad to see me, and I hope my next date will be the Casa Inglese. The provisions are all prepared so far as I can see to them, but as I am to have daily communication with Nicolosi, I hope to repair omissions. As I have not of course tasted butter since I left Messina, my great point is to see to the milk. They take great care about wine, but cannot be brought to believe that coffee and tea require milk. Yet most of them think goats' milk better than that of cows.

Casa Inglese: September 21.—Got off with two guides and two muleteers and four mules at half-past seven, in bright sunshine, from Nicolosi, and after a beautiful sunny

ride of three hours through wooded craters, protected from the heat by my umbrella, was gradually enveloped in clouds. I saw a lava stream, where the oaks had been surrounded by lava which had taken the form both of upright and prostrate trunks, surrounding them with tuff, and the wood being burnt up they are now cylinders of scoriaceous lava. After a couple of hours we got above the clouds, when about 8,000 feet high, but not till my hands were numbed, for I could not believe for a long time in the necessity of my putting on a cloak. After reaching this place I set out with Angelo for the top of Etna, leaving Giuseppe to cook. We had now and then a small drifting cloud, but on the whole splendid sunshine. I saw the spot at the foot of the great cone where the Catanians, as I mentioned in 1830, quarried ice from under a current of lava. My guide saw the same done six years ago, while the eruption of 1852 was going on in August and September ; the sand and lava ten feet thick, and four feet of ice below (once snow), and bottom not seen. When there is a scarcity of snow they send to this reservoir. Not far above the ice I warmed my hands at a fumerole, where the steam and some sulphuretted hydrogen were given off at such a heat that I was obliged to be careful how far in I put my fingers. This welcome heat enabled me to write. The bank of clouds below us was such as aeronauts describe, finely lighted, some parts representing even plains, others alpine heights one beyond another, some nearer masses moving apparently much more rapidly than others. When we reached the edge of the crater, the whole of Sicily was hidden except the higher part of Etna between us and the Montagnuoli. But Lipari and Stromboli stood out in the sea very conspicuously.

I made a rough sketch of the two craters ; the smaller one has lately, I believe, fallen, and shows a section of some of the horizontal beds of lava with which it has been filled up nearly to the top. It seemed to me about 200 yards diameter and perhaps 150 yards deep, and the great crater, separated by a very narrow partition, vertical on one side and steeply sloping on the other, seemed three or four times as wide and deep. It was a considerable exertion climbing and going half round it, after a seven hours' ride, and this

makes the Casa Inglese, which is the roughest place I was ever in, seem a hospitable mansion, as it saves our returning. The wind is whistling round, and somewhat through it, but Dr. Giuseppe, I hear, has made it weather-tight. There is no chimney, and we have charcoal burners, but if the wind always blows like this, I am at any rate guaranteed from asphyxia. I was determined to write to you before trying Mr. Jeans' hammock. The two guides have an adjoining room. Our muleteer has taken back the mules, and I have offered him a reward if he brings me up milk tomorrow, which the others promised to obtain on the way, and failed.

September 22.—Two experiments at once—this house, and a hammock to sleep in for the first time—was too much, for this house is the roughest I was ever in, since we cannot let in the light by the one window, which is without glass, without admitting a blast which in a minute annihilates an hour's warming of the charcoal apparatus.

The well-swung hammock pitched like a cutter in a short sea when I got in and out, and rolled like our old friend the 'Britannia' steamer when I was restless, so that I lay awake wondering whether I should be sea-sick, withal a smell of an occasional whiff of sulphur from the highest cone. Having come down from that cone hungry, I had eaten too heartily just before going to hammock, and this was perhaps the chief reason of a sleepless night, just as I have got to where the cold protects us from musquitos. I was glad when daybreak was announced, although accompanied by Giuseppe's anticipation of snow. The sun, however, conquered, and I got a fair day's work, breaking ground on those enormous precipices below the flattened dome-shaped area, on which the principal cone with its two craters rises, and on which also this wretched remnant of the earthquake-ruined edifice which the English army built, stands.

There were clouds below all day, but we were generally in sunshine.

To-night I have been taking various measures against cold, for having tried with the guides to plan all manner of ways of exploring certain parts of Etna, without coming and staying here two or three days, we find it an unavoidable evil.

Everything one touches is like ice just now. The floor so uneven that a touch causes a chair to fall, and it is strewed with sand like the lavas which surround the volcano.

September 23.—Before I was up, about dawn, the arrival of five English officers of Captain Clifford's ship the 'Centaur' was announced. They had encountered rain in the night, and though they went to the summit, saw nothing but the rim of the crater. I was much pleased with their chief, the second Lieutenant de Kantzow, of Swedish origin he told me, at least the name,—well read in my works, and had tried hard, but in vain, on several occasions, to get near the lava of Vesuvius during the late eruption. The heat was too great. He thought me singularly lucky in what I saw, and I must remember this good fortune when I am disposed to abuse the quarantine regulations for causing me to have this struggle with the elements up here. However, I had a much better night, managing by dint of clothing to warn off the great enemy cold.

The compact lava I found yesterday is one great reward for coming up here, as I can so easily refer to the place. It is perhaps my best case, and the Royal Society will let me add it with the new date.

To-day I have explored the Montagnuoli, and feel sure it is a simple case of a double cone, the newer one thrown up in the common way. How Abich could think otherwise I wonder much. To-morrow I hope to descend into the Val del Bove. The mists to-day have interfered more than any previous one with my geologising.

Casa Inglese: *September* 24.—Giuseppe, the son of the innkeeper of Nicolosi, was amusingly put out by the roughness of the quarters here, where he had never slept before, and formed all sorts of schemes for enabling me to explore the precipices of the upper region of the Val del Bove without braving the rudeness and coldness of things up here. I think the guides' room the warmest and lightest of the two, and have therefore been sitting there nearly half the day with Angelo, who is alone here. For I sent Giuseppe round by Nicolosi to Zafarana, meaning him to bring the mules to the foot of the great precipice, weather permitting, and so to go on to my old quarters at Zafarana.

But we had rain and snow whitening the ground, and ever since a regular Scotch mist, and instead of the grand scenery of this spot, you would fancy yourself in shooting quarters on some Highland moor. I have at any rate had a day of rest from fatigue, whether of body or mind. Got a good read of Hoffmann, and however dry he and his editor Von Decken may be, the book interests one on the spot, as the rocks he describes in detail are what I have been collecting, and the places so many of them what I have seen or have to see. But the most useful part of the day's business has been the planning each day's excursion with mules till the day I must leave for Messina, availing myself of Angelo's local knowledge of distances, inns, and places and sights, and the power of mules. It is a most difficult country, Etna,—especially the lavas so often interposing a barrier to mules, and an immense delay to men on foot. I have written all out, and allowed for some rainy days, and three or four in Catania. Angelo, a hardy peasant, is only diverted with Giuseppe's dismay, and it is amusing how little the education of the one makes up for the superior mother-wit of the other. In most of my future excursions I mean to dispense with Giuseppe and have a muleteer under Angelo, who gives me most information when alone with me. Lieutenant de Kantzow, to whom I had presented some milk for his tea, presented me with half a bottle of good brandy. It has done me good by spoonfuls, as the wine here is too acid for me. By putting on all my clothes double I have kept warm, and have often thought of Samuel Rogers' maxim, that a man who suffers from cold must be a fool or a beggar. If it were some tropical volcano, how much more difficult to contend against the enemy!

26.—Yesterday I made the grand descent of the Balzo di Trifoglietto, 4,000 feet, and really without much difficulty, and in about three hours, spending a great deal of that time in observing the interesting fact, that in the middle of this cliff, the head of the Val del Bove, and just below the great cone, the strata are perfectly horizontal—a fact first made out by Waltershausen and I think first explained by me. I had made up my mind that possibly Giuseppe, from want of courage or from taking a different view of the state of the

weather, concluding I should not descend, might not bring the mules to the foot of the precipice. It turned out that he had come for me the day before, in spite of the bad weather, and had returned yesterday, but lost his way in the mist. So we found no one; but after walking an hour and a half, I told Angelo to go to Zafarana, get the mules, and return to my rescue. There was time for all this before daylight was over. Angelo proposed to give one more loud halloo, which we gave, and were answered by splendid echoes from the surrounding vertical walls of the grand amphitheatre. But Angelo was positive that there was more than an echo. I could not believe it, though he turned out to be in the right, and after nearly an hour the lost Giuseppe found us, and I got to Zafarana between three and four, just 7,500 feet below my station of the morning—a most agreeable change of climate, bed, and all things. To-day I have come to Giarre, having re-examined on my way the Cava Grande case, of steeply inclined lava.

I have had a long talk with Dr. Mercurio. He tells me there are *two* comets, but it is too cloudy to see them to-night. I was glad to be free to-day from that chattering Giuseppe. Angelo and Delfo the muleteer are now my companions.

Aci Reale: September 27.—I have satisfied myself that Don Carlo Gemellaro is right, and that the basaltic columns of the Grotte delle Palombe belong to a lava, which instead of being the oldest, is newer than all the currents of Aci Reale. I found a cliff 600 feet high or more, inclined at an angle of about 50°, and cascading over it reduced the slope to 23°. So that Waltershausen is wrong in his view, suggested, I suspect, by the old superstition for which Von Buch has in part to answer, that columnar basalt is an *older* production than ordinary lava.

Before leaving Giarre, I revisited the bed of the torrent where I found last year a current of columnar basalt reposing on the old alluvium of Giarre, and shall be able to make the diagram given in my paper more exact and instructive.

Catania.—Called on the British consul, and had the happiness of receiving two of your letters. . . .

Casa Inglese, Etna: October 1, 1858.—Here I am once more in these elevated quarters, about 10,000 feet above the sea, having fine weather, and having flattered myself that I shall get off with one night, making to-morrow the descent of the Montagnuoli, as I have already done the loftier but not equally precipitous height of the Giannicola. Yesterday morning I had appointed Gravina between seven and eight o'clock to start with me. The news came that Angelo, having out of his punctilious honesty preserved the fag end of a ham used in the last excursion, had been stopped by the police at the entrance of Catania (coming from Nicolosi), with the three mules. So I had to get Gravina to apply to the chief of the police, and while he was so employed got my breakfast and saved my character for punctuality.

I had a good day's geology at Fasano, which you may remember on the road to Nicolosi, St. Paul, and Catera in that neighbourhood, Gaetano Gemellaro meeting us, and he and Gravina wanting my opinion on a geological point on which they had been contending. I forgot to mention that the day before Aradas had given me a list of 150 shells of that Newer Pliocene clay on which Etna rests. Nine-tenths of them agree with Mediterranean species; but as he means to lend me the whole collection, which I hope to get Deshayes to overhaul, it will be a valuable addition to my paper, as giving a precise paleontological date to the volcano, the same in truth as I gave in 1828, which is satisfactory. In truth, the first twenty-five species of shells would generally give the result which 150 afterwards confirm.

Zafarana.—I came down the heights under the Montagnuoli, about 3,000 feet, without fatigue seeing the rocks on the way. It would take weeks to study such countless dikes and lavas, but I read off not a few of the principal features.

We were met at the foot of the hill as near the appointed time as could be expected, and I now feel that the most difficult part of the task is accomplished, as I have verified the fact of the inclination of the lower, the horizontality of the middle, and the unconformable southern dip of the uppermost part of the great 3,000 and 4,000 feet high precipice.

October 3.—I have accomplished a ride I always wished to make, and which Waltershausen, not having knowledge

or faith enough in mules, believed I should never make out. I got from here almost without stirring from my saddle, up the external valley, one outside of the Val del Bove, called Cava Secen, and so ascended gradually till I reached the narrow rim or knife-edge which divides the Val del Bove from the outer slope. I wanted to see among other points whether the junction of this deep valley (of Tripodo) with the rim of the Caldera or Val del Bove was marked by a depression or notch, or what the Americans would call in reference to the Alleghanies 'a wind-gap,' for you probably remember there is not a single 'water-gap' like the Barranco de las Angustias in Palma, allowing a river to pass out of the Val del Bove. It is strange that no one in Catania could help me as to this point, and yet there is not a more marked feature in the geography of Etna than the deep indentation, narrow, and I should guess 800 feet deep, if not much more, which marks the situation and the unbroken rim of the water-shed between this Val di Tripodo and the Val del Bove, or a narrow ravine which descends inside into the great Caldera. My guide, perhaps the most experienced on Etna, never was there before. It is a most picturesque spot. On the one side is a deep Alpine style of valley, the rocks covered with old beech trees, on the other a look into the great gulf or cauldron-shaped amphitheatre, with Etna steaming away and the great range of precipices below it, and on the left, between the point of view and the Montagnuole, a series of five or six vast promontories one behind the other, about 3,000 feet high each, without a shrub, but pinnacled with dikes, some standing up fifty feet or more. The whole scene of the valley was shown in sunshine for half an hour, and the crater of Etna; then the clouds gathered rapidly, and thunder soon began, but we rode back in sunshine, soon escaping from the mists.

Nothing amused me more than going to see what such a torrent as that of Tripodo did, when a very powerful lava current, such as that of 1792, has blocked up its mouth and drunk up all its waters. The lava cannot absorb its sand boulders and mud. So the torrent has been working away for eighty years, and has already filled up a lake-like cavity, and redeemed the space of a large field from the sterile

domain of the lava, and when it once gets its alluvium high enough to overtop the lava, the side of which has been probably thirty feet high, it will get on fast with its fertilising soil, leaving occasional black ridges projecting above.

Zafarana: October 4.—I got off by six o'clock this morning, Etna and the whole region without a cloud, and secured six hours' good survey of the centre of the valley, and the craters and lava of 1852, having now satisfied myself that Gaetano Gemellaro was quite out about the rock he still will call Musarna, and his uncle Giuseppe very wide indeed of the mark, in laying down his three points of eruption, and in some respects the direction of the lava.

The views this morning were very fine. Just at twelve o'clock the first white speck of cloud appeared on Mont Zoccolaro, and it soon began to roll into the great valley, and filled it with mist in an hour. We rode down out of it and reached this soon after two o'clock in sunshine. I have now done what I intended of the higher and difficult region, and am now going round the base to see all the tertiary and secondary strata which peep out from below the ever encroaching envelope of lava. I hope by this means to be able to speculate on the nature of the pedestal of Pindar's 'pillar of heaven.' I must take care of the mules now they are in the plains. I feel here, as in Madeira, that a good mule is like presenting an old geologist with a young pair of legs. They would mount up the side of any English stone quarry where a man can get, and you need not be merely taken to the quarry's mouth.

The comet is most splendid on a moonless clear night in the north-west. I hardly think that that of 1811 was brighter, but the tail was much longer.

Randazzo: October 6, 1858.—After leaving Giarre, I wanted to see a small outcrop of tertiary between Piedemonte and the sea, and not having found Dr. Mercurio was looking out for an informant, when I saw by the road-side an architect whom I employed last year to copy a map of the rivers coming from the Val del Bove which he had been employed to make by Waltershausen. He was one of the few men in Sicily who could exactly tell me where and how to go

to the point with my mules. He was amused to see Waltershausen's map. His name is Vincenzo. I spent a pleasant hour on a hill-side collecting old friends, *Dentalium elephantinum*, *Venus dysera*, *Pecten jacobæus*, *Limopsis*, *Pecten varius*, and many others, the guides and muleteer also helping very well. We then went to Linguagrossa, bad quarters, but luckily Don Gallo of Giarre had set me up with provisions. At such places (and it is the same here) they are thankful if you want nothing but a bed. If you insist on the whole room you pay for *two* beds, only two carlines each! The cone of Mojo which I passed to-day, the most northern dependency of Etna, reminded me of Tartaret by its situation in the middle of the river's 'thalweg,' and I find many remembrances of Auvergne now that I am on the borders of the volcanic and Eocene formations.

I passed a good deal of heath (*Calluna vulgaris*) to-day on the lavas, and abundance of *Cyclamen Europæus*; also a short-stalked purple *mallow* (I think), very handsome; the yellow crocus large; the *Colchicum autumnale*. A good deal of *Euphorbia*, like English, I think, but larger, and a second species; and the 'weebo' of Forfarshire, and 'traveller's joy,' and hawkweeds and others, all almost entirely common British weeds, such as *Euphrasia*, &c.

Bronte : October 7.—Have had another fine day for surveying the northern and north-western side of the volcano. Saw the place where a crowd assembled in 1842 to see the lava flow into a great artificial reservoir of water. The melted current of stone came forward with a front thirty or more feet high, and falling suddenly into the water produced for awhile no effect whatever, as if, like white, hot metal in Butigny's experiment, it required to cool down before it could cause explosion. At length it went off suddenly, and everybody but one or two, fifty or more in number, were killed, asphyxia it is said, for no wound was found on anybody. Had it not been for some heavy rain many hundreds would have been there.

Catania.—I made out my journey well yesterday evening, and cannot sufficiently congratulate myself that I should have been so many days for eight hours a day on mule-back on such roads and crags, and without the smallest

accident. The chief difficulty is the food, but I have learnt by degrees how to manage.

I feel most thankful for the privilege I have had in going over and checking my own and Waltershausen's observations previously to printing my paper, which will gain greatly in that kind of minute accuracy which is desirable when one's facts bear on controverted questions, with the disputing of which the *amour propre* and reputation of living authorities is most sensitively concerned, and I have had the pleasure of being greatly strengthened in my convictions. Your very affectionate husband,

CHARLES LYELL.

CORRESPONDENCE.

To MRS. BUNBURY.

Casa Inglese, Etna: October 1, 1858.

My dearest Frances,—The cold in this habitation, about 10,000 feet above the sea-level, is uncomfortable, but sleeping here, which I am doing for the fourth time, having returned to it a second time, is the only way of examining great precipices which are a key to the structure of Etna. I have found striking confirmatory examples of the fact that lavas form sheets of excessively compact rock on slopes of 35°, and they can form continuous stony masses at an angle of 40° without vesicles! It is strange that this should have been denied on such scanty grounds.

I should not think that Etna would afford a rich botanising ground in comparison with its size and height. The eruptions destroy plants, and the single ones which can live on loose sand, or can stand the barren lavas, such as broom and *Hypericum*, and some others, monopolise large tracts. The *Cyclamen Europæus* is abundant, and like the *Crocus* (or *Colchicum*) *autumnalis*, very ornamental, and the yellow crocus, but that is rare. Also another purple flower which I must learn the name of—not English, I feel sure. Heer, when he decided that one of my fossil plants from the tuff was *Pistaccia lentiscus*, said it was not in the floras of Etna which he had seen in print, but I saw it yesterday so

abundant that I cannot suppose it had all strayed from gardens.

There are but few travellers here this year, so I am sorry two are coming up to sleep here to-night; but they can have a separate room. I have not yet seen the comet, which you seem to have a good view of, but my guide announced it ten days ago 'as a new planet, one he had never observed before, with a streak of light proceeding from it,'—not a bad description for a most illiterate peasant.

There is a great pleasure in reiterating one's observations on one limited area like Etna, and considering the volcano in all its bearings and its age as proved paleontologically, its structure, the relative date of its valleys, and so on.

In consequence of the death of Carlo Gemellaro's only daughter, I have got little help from him and his son this time, but others have aided, and I feel very independent with my guide of last year, who knows enough Italian to get on pretty well with me. My correspondence and talk has been so much in Italian, that had the Sicilian spoken the real language I should have made great progress. To hear my guides talk, you would suppose that the staple of Sicilian was 'da bano,' which I am told means 'dall' altra parte,' but if it meant nothing more, it could not by any ingenuity be introduced so often. When they talk together I hardly catch a word, yet their newspapers are like those of Tuscany or Rome as to diction.

The clouds have rather interfered with some of my work in the higher region, but all Etna has been clear to-day, and since I began this campaign I have only lost one day by rain, and that was when last up here on the summit. And yet when I came they had had five months of fine weather.

Zafarana.—I have descended safely into the region of vines from 10,000 to 1,800 feet above the sea, and have studied another part of the great precipice on a fine day, and found *all right*; but I must confess that the lower third out of 3,000 feet is such a wonderful instance that dikes have intruded in such numbers and of such thickness as to make the beds they invade seem to play a subordinate part, that other theorists may be expected to find facts to suit their doctrines.

Zafarana: October 3.—I have told Mary of a ride which perhaps delighted me the more as it was one never recommended to me, and which I cannot find out from the guides anyone has been at, though of course Waltershausen got to the point when he made his map. It seemed to me the most beautiful scenery I had yet seen, the dividing ridge as sharp as the crater of Etna itself, between the great Val del Bove, which you look down into in its grandest part, and the Val di Tripodo, the only considerable valley which furrows the side of Etna, and which is well wooded, and contrasts finely with the savage scenery of the Val del Bove, now almost without a spot of green. I won't say it beats the north of Madeira, but no one has seen Etna who has not been there.

October 4.—I have had another fine ride into the centre of the Val del Bove, to study the effects of the grand eruption of 1852. The two craters after rain still send out such volumes of steam that they look as if they were beginning a new eruption, but without such fuel they scarce give any signs of life.

I must conclude this with my love to your husband, who will, I hope, tell me by the end of the month what he has been doing in his study in the way of fossil botany since I saw him. I little thought when I wrote to Sir Henry Bunbury about the Casa Inglese, that I should ever see it again or sleep in it. The lawyers here say that they who built it, and have repaired it, have the property as squatters, and neither the Prince of Palermo nor his assignees have any objection. But the singularity of the case is that no one can say who it is that has squatted there.

The Gemellaros say the English army, others say the Gemellaro family, and so stands the case. Dr. Giuseppe, who has an income so small it would astonish an English apothecary, has spent 15*l.* this year in repairs, and more than half out of the subscription I sent him.

Believe me ever yours affectionately,

CHARLES LYELL.

To His Sister.

Messina, Sicily: October 16, 1858.

My dearest Sophy,—No excursion could have been more successful in a geological point of view than my re-examination of Mount Etna, and the strong and sure-footed mules of that country gave me the power of scaling such heights as you climbed so successfully in Switzerland by means of the same power. The beautiful climate of autumn in this island makes up for much of the drawbacks in the way of bad and dirty inns, or rooms with beds where they do not profess to have inns. But nothing but a considerable scientific excitement could carry one through. I was often afraid I should not keep well where the diet was so strange. They cannot understand a man caring for milk and butter, but here at Messina I see these rarities again. Night after night I stopped with my guides and muleteer at large towns, with grand churches and priests and friars without end, and processions and tolling of church bells, and monasteries, as at Linguagrossa, Randazzo, Piedemonte, Bronte, where there was not a single inn. You find at last a dirty hole where they show you one or two rooms, in which there are two or more beds, but nothing else, and before the white sheets are brought, they look like pieces of furniture less inviting to lie down upon than those lavas of Etna which are liberally sprinkled with volcanic sand. You then bargain that no one is to pass through your room and that no one is to sleep in any other bed in it. You accordingly pay for the other beds; a mere trifle. You promise something extra for water and a towel, and send out your guide to try and buy something for food—bread and eggs at any rate, and you may have brought with you some tea, a teapot, salt, sugar, and Bologna sausage. Sometimes you have a landlady who, having never seen an Englishman before, can scarcely be kept by lock or bolt from prying into the room and watching all your proceedings, to learn what you can want with basin, towels, and other articles, never I suppose asked for before. But the worst trial is the dirt of your own servants, guides, and muleteers, who during the ten days they are with you never wash or change raiment, if indeed they ever did

before or after, but if you have fine weather and scenery in the daytime, and are laying in a store of scientific facts, and tired enough at night to be sure to sleep, and hungry enough to be glad of bread and eggs, and above all, if you have no one to blame but yourself when you feel you are in a scrape so far as fare and comfort are concerned, it is extraordinary how one comes through it all with health and spirits. I must say it often did me good to think how much worse our officers fared in the Crimea, and under an Indian sun, to say nothing of being shot at to boot. I usually held my umbrella over my head five or six hours of the day, except when in the Casa Inglese, where we had snow and a difficult fight with the cold. I slept there four nights, and was glad when they were over, but they repaid me amply.

I made some pleasant excursions from Catania with the geologists of that city, and am going to-day with a M. Sequanza of this place to explore a valley near the town, where we shall find a great many fossils, and have splendid views of Messina, the Straits, and deep blue sea, and opposite coast of Calabria.

Believe me, my dearest Sophy, your affectionate brother,

CHARLES LYELL.

CHAPTER XXXIV.

FEBRUARY 1859–NOVEMBER 1860.

AGASSIZ MUSEUM—OWEN ON THE 'GORILLA'—MR. PRESCOTT'S DEATH—LORD LYNDHURST—MANSEL'S 'BAMPTON LECTURES'—BRITISH ASSOCIATION, ABERDEEN—DARWIN'S 'ORIGIN OF SPECIES'—BIRTHDAY PARTY—DEATH OF MACAULAY—DAWSON'S 'ARCHAIA' ON EVOLUTION—FLINT IMPLEMENTS IN THE VALLEY OF THE SOMME—DEATH OF CHEVALIER BUNSEN.

[He visited Holland, Paris, and Le Puy in the course of 1859, and in September presided over the Geological Section at the British Association, Aberdeen.

In 1860 he was in Germany, visiting Rudolstadt and Coburg, and in the autumn went to the Oxford British Association. In these years he turned his attention especially to the antiquity of man.]

CORRESPONDENCE.

To George Ticknor, Esq.

53 Harley Street, London: February 16, 1859.

My dear Ticknor,—I was glad to learn from Prescott's last letter, that Agassiz was stirring about a museum, and that at a meeting at James Lawrence's, the Governor had promised aid from the State. With the splendid bequest left by Mr. Grey, I hope something grand will come of this. There is no getting on without such collections. Sir Philip Egerton told me the other day, that he must go to Vienna to compare some fossil fish with the recent collection, so much more complete there than in London or Paris. I expect we shall have to go to Boston instead, if once Agassiz has free scope in that particular branch.

I saw Mr. Harness (the Rev.) just now, who was remarking to me that although Milman is very well, he is

much more bent, and therefore older looking than ever, but he is in good spirits. These evening services in St. Paul's have given him much to arrange; rather fatiguing, and some preachers inflict more than an hour.

The Italians here have been annoyed at Mazzini for having expressed no sympathy at the alliance of Sardinia and France, and the promised aid, and they said to him that if they could get help from the devil himself, they ought to jump at it. His answer was, 'You will have the devil and the Austrians too.' My friend Dr. Falconer obtained on his way through Lyons a fine cast of a species of fossil Rhinoceros, which we have in the valley of the Thames also. At Naples the police voted it to be an infernal machine, and took it away. It was five weeks before (after much trouble) it was restored, but some MS. on osteological subjects in Falconer's not very legible handwriting, was submitted to certain priests, who still think it treason. I fear that when he gets to Palermo he will find the prisons full of newly arrested men of family. Affairs there are much as in 1847–48.

Charles Murray is returned from Persia, and we are to meet him at dinner at Horner's on Monday.

My three nephews and niece are quite well and in spirits, after their summer's illness. Susan Horner's translation of Colletta[1] reads well, and has come out at an opportune moment, when so many are thinking of Italy.

Owen has been reading a paper to prove how much nearer the Gorilla comes to man, osteologically, than does the Chimpanzee, but he seems not to have more, if so much intelligence as the elephant; so whether the Lamarckians will profit much by the fact I cannot foresee, though they may do so if the Negro is more like the Gorilla than the white man. I am rather suprised at the popularity of the doctrine of a chain of beings leading up to man. Agassiz is very fond of it, and strains a point for it, as do some others, while they protest against Lamarck's transmutation, but they are I suspect drifting towards the same goal without knowing it.

Ever affectionately yours,

CHARLES LYELL.

[1] *History of the Kingdom of Naples*, by General Colletta. Translated by S. Horner.

To GEORGE TICKNOR, ESQ.

53 Harley Street, London: March 11, 1859.

My dear Ticknor,—Mary is writing I find by to-day's post on a subject[2] which has been so much occupying our thoughts, as it has yours, and on which so much has already been well said and felt, on both sides of the Atlantic. Mr. Prescott's correspondence with Mary was so frequent, that we cannot see a mail come in from America without sorrow, to think that there can be no letter from him. I am sure there is no one of his friends to whom his death will be so great and permanent a loss as to you. The universality of the expression of grief and regret has not surprised me, but I have felt some consolation at the unusual amount of ability and eloquence, and upon the whole good taste, of the various speeches and biographical sketches extemporised on this occasion, especially in the United States.

No impartial reader can peruse them without feeling that from such a soil and in such an atmosphere great literary men must continue to spring up. In spite of the warning given by Prescott's attack a year ago, I was quite unprepared for his being taken away from us so soon. A letter which he wrote to me five days before his death was in his usual cheerful and sprightly tone.

I have been amused at meeting and conversing with two notabilities since I last wrote to you, whose minds preserve remarkable vigour and liveliness at a great age, Lord Lyndhurst eighty-seven and Brougham eighty. The first I met at a dinner at the Palace. I had not seen him to talk with him for thirty years, when I passed several days in Trinity Hall, Cambridge, where Copley, the Attorney-General, was staying. He alluded to those days as 'jolly times,' and then questioned me as to the latest geological discoveries respecting the antiquity of the human race. I told him among other things, of Horner's paper on 'Egypt,' proving that pottery was made there 13,000 years ago, and told him I would lend him the paper. On receiving it a few days later, he wrote to me to say that he had found out that Bunsen in some

[2] The death of W. H. Prescott, the historian.

paper just published had arrived at analogous results from different data and by another process; a discovery which amused me, for in that short interval he (Lord Lyndhurst) had been occupied in addressing the House of Lords on the removal of the Royal Academy to Burlington House, giving a sketch of their history, legal rights, &c. But though his mind is clear and lively, he can only get upstairs, or even go from the dining to the drawing-room, with the help of an attendant. It was pleasing to see the Queen paying the attention due to his years, and introducing the Princess Alice to him.

Brougham is upright and strong on his legs, and amused me by almost confessing his sympathy with a new pamphlet on the 'Reform Bill,' by John Austin, once as great a Radical as ever Harry Brougham was, and now as much of an alarmist as any Tory can be. We met him at Milman's. Lord Lansdowne was to have been there, but had to go to the Duchess of Cambridge instead. He is getting a little deafer, otherwise very well on the whole. We dine with him to-day. Lord Stanhope and the Bishop of London were at Milman's, and Lord Shelburne, the day we met Brougham, and they discussed the new Reform Bill very freely. The Bishop says that the artisans are so much more intelligent than the small tradesmen, that those of the former class who have any property would make a far better constituency than the tradesmen, to whom we are in danger of transferring so much power. I fully believe this, and think the scheme of votes for those who have 60*l.* in saving banks a good idea.

Have you looked at Mansel's 'Bampton Lectures' on the 'Limits of Religious Thought'? There were many fruitless discussions among the dons of Oxford, how to force the young men by various pains and penalties to attend the University Church, which was nearly empty, but there were no precedents for such proceedings. At last some original thinker suggested, that possibly if they named some good preacher it might remedy the evil. So they made inquiries for some young men of ability, and found this Mansel, who forthwith filled St. Mary's to overflowing, and when the lectures were printed they soon reached a second edition. A friend of mine, Huxley, who will soon take rank as one of the first

naturalists we have ever produced, begged me to read these sermons as first rate, 'although, regarding the author as a Churchman, you will probably compare him, as I did, to the drunken fellow in Hogarth's Contested Election, who is sawing through the signpost of the other party's public-house, forgetting that he is sitting at the outer end of it. But read them as a piece of clear and unanswerable reasoning.' Soon after I had seen them, I was recommended by Sir Edward Ryan to read a powerful article in the last 'National,' in answer to Mansel, by Martineau; and certainly it is worth reading, and shows among other things, in an episode devoted to Butler's 'Analogy,' how much more comfortable and consolatory is the system of creation, or the divine dispensation, when viewed from a Unitarian than from an orthodox point of view. At length, after expending much admiration and adulation on their new defender of the faith, the Oxonians have become alarmed, and Milman told me that one of them had written to Hampden 'You are avenged;' while Dr. Jeune had exclaimed, 'To think that I should have lived to hear Atheism preached from the University pulpit, and the member for Oxford recommend the worship of Jupiter!'

You will understand, I daresay, the last hit better than me, for I have not read Gladstone's Homeric lucubrations.

I must conclude, as I have to go to Owen's lecture on 'Fish.' He assured us yesterday that every act of thought, even in a reverie, is so far material that we are the worse for it, and require reparation through the digestive organs. There is something *burnt*, or a loss of oxygen, by every, even the slightest effort, of the brain in thinking.

Ever affectionately yours,

CHARLES LYELL.

To MRS. BUNBURY.

Leyden: April 22, 1859.

My dearest Frances,—We have just returned from an excursion to the sand dunes of Catwyk, at the mouth of the Rhine, collecting shells, star-fishes, spatangi, seaweeds, and other treasures on the sands over which the waves were rolling on a very bright day. We then visited the sluices by which the water of the Rhine is let off at low tide, so as to

drain the inland country, and sever out a passage through the dunes which used to intercept the water of the river before Napoleon I. made these sluices; having cut a canal through the dunes. On the sand hills we gathered abundance of wild pansy, a small *Myosotis*, *Stellaria*, groundsel, and a few other plants in flower. We saw in the gardens and suburbs of several villages on our way large patches of brilliant tulips, of all colours, arranged in groups.

In the Museum here we saw parts of a crab called *Inachus macrocheirus*, from Japan, which they calculate is eight feet long when entire. I had thought that the Devonian crustacea, *Pterygotus*, &c. which they say were seven feet long, exceeded any of the creatures of these degenerate days, but one never sees a rich collection like this without being convinced how little one knows of the present inhabitants of the globe.

I rather think it is thirty-six years since I was last in Holland. I am sure the Hague must have doubled at least in size and population. It is a very handsome city now.

Ever affectionately yours,

CHARLES LYELL.

To MRS. HORNER.

Aberdeen :[3] September 15, 1859.

Dearest Mamma,—As you asked me to write I will send a short letter, and send it to-day unless interrupted in this busy time.

Dr. Fowler, at ninety-four, looks well enough, but having eaten turtle soup and melon too close to the rind, and other imprudences, is not quite well to-day. I went in the Provost's carriage to dine at Banchory, to meet the Prince, Sir Roderick Murchison, General and Mrs. Sabine, Sir David and Lady Brewster, Lord Rosse, Duke of Richmond, and several local managers of the Aberdeen meeting. I sat next General Sir Charles Grey, whom I always find agreeable.

At the evening meeting I was on the platform next Lord Ashburton, who introduced himself, as he says he does to all his friends (since his return from the East with a beard), as not a soul knows him. He is quite changed by it. The Prince's speech was well delivered. We shall send it

[3] At the British Association.

to you when we get it, perhaps to-day. In consequence of General Grey talking with me about the flint hatchets of Amiens, he for one determined to hear my opening address. I had thought it best not to ask the Prince to be there, lest it should interfere with other arrangements, though I had two talks with him at Banchory. But next morning Sabine came with a message that H.R.H. the President requested me to defer my opening speech till he could attend at twelve o'clock, so I got on Prof. Nichol first, on the 'Geology of Aberdeenshire.' When the Prince came, the room, which had been gradually filling, must have contained about 800. The Prince, the evening before, had 2,200, and many ladies had been refused tickets.

Young Geikie[4] has read the best paper to my mind yet presented to our section, on the 'Age of the various Trap Rocks of Scotland.' He finished by endeavouring to prove the top of Arthur's Seat to be tertiary! Of the young men he is certainly the coming geologist and writer. I am glad Horner likes his book. I expect he will one day be a leader in the Ordnance Survey.

My address, which I hope to send you to-morrow in the newspaper, will be a full answer to Horner's very natural suggestion about the Denise fossil man. We have talked with Symonds of Pendock (who was escorting a daughter of the late Hugh Miller,) with Sir Richard Griffith, Profs. Ramsay, Huxley, Harkness, Lord Monteagle, Mr. Vernon Harcourt, Prof. Phillips, Sir Philip Egerton, Sir James Clark, Dr. Allen Thomson, Dr. Gould, Sir William Jardine, Prof. Owen, Mr. Hopkins, &c.

Sedgwick was to have dined at Banchory, and slept there, but wrote on the day to say he could not come, having a cold, but hoped to be here on Saturday.

Sir James Clark wanted Mary to go to a ball at Balmoral on Monday, but she will stay with me, and perhaps go with the Clarks to the luncheon, to which I shall probably go at Balmoral on Thursday the 22nd.

With love to all, ever affectionately yours,

CHARLES LYELL.

[4] Professor Archibald Geikie, Director of the Geological Survey of Scotland.

[After the meeting of the British Association at Aberdeen, Sir Charles Lyell asked Mr. Symonds to accompany him to Elgin to investigate the history of the *Elgin Sandstones*, which contained the fossil remains of the supposed Old Red reptile, Telerpeton. The late Sir William Jardine, Professor Harkness, and Lord Enniskillen also went with them. After many days' examination, Mr. Symonds came to the determination that the Telerpeton beds were New Red—not Old Red—and it turned out that he was right eventually.]

To CHARLES DARWIN, ESQ.

Drumkilbo, Meigle, Perthshire: October 3, 1859.

My dear Darwin,—I have just finished your volume,[5] and right glad I am that I did my best with Hooker to persuade you to publish it without waiting for a time which probably could never have arrived, though you lived to the age of a hundred, when you had prepared all your facts on which you ground so many grand generalisations.

It is a splendid case of close reasoning and long sustained argument throughout so many pages, the condensation immense, too great perhaps for the uninitiated, but an effective and important preliminary statement, which will admit, even before your detailed proofs appear, of some occasional useful exemplifications, such as your pigeons and cirripedes, of which you make such excellent use.

I mean that when, as I fully expect, a new edition is soon called for, you may here and there insert an actual case, to relieve the vast number of abstract propositions. So far as I am concerned, I am so well prepared to take your statements of facts for granted, that I do not think the *pièces justificatives* when published will make much difference, and I have long seen most clearly that if any concession is made, all that you claim in your concluding pages will follow.

It is this which has made me so long hesitate, always feeling that the case of Man and his Races and of other animals, and that of plants, is one and the same, and that if a *vera causa* be admitted for one instant, of a purely unknown and imaginary one, such as the word 'creation,' all the consequences must follow.

[5] On the *Origin of Species*.

I fear I have not time to-day, as I am just leaving this place, to indulge in a variety of comments, and to say how much I was delighted with Oceanic Islands—Rudimentary Organs—Embryology—the Genealogical Key to the Natural System—Geographical Distribution; and if I went on I should be copying the heads of all your chapters.

With my hearty congratulations to you on your great work,

Believe me ever very affectionately yours,

CHARLES LYELL.

To DR. JOSEPH HOOKER.

London: November 13, 1859.

My dear Hooker,—Your generalisations on species are worth more to me in proportion to the vast numbers of individual forms and varieties with which you deal, and to the more extensive grasp which the botanist has already got of the earth's flora, than the zoologist has of the fauna. I therefore wish all the reasoning in the old New Zealand Essay, in the review of De Candolle, Introduction to 'Flora Indica,' and in your new book, could be given in one 8vo. volume, referring for details to the Essays.

Reviews, even when not anonymous, are so apt to be classed with ephemeral criticisms, in which the usually unknown and half responsible critic writes off-hand on the book he is treating of, that it is not the best channel for recording with a date the results you had then come to, after collecting personally a greater body of evidence than any other naturalist has brought to bear on a momentous question.

Ever affectionately yours,

CHARLES LYELL.

To HIS SISTER.

53 Harley Street, London: November 15, 1859.

My dearest Caroline,—I have to thank you for your kind present of a purse, which will be soon useful, as Mary says I wear mine out very fast. I wish you could have seen the boys romping for nearly five hours, and very well behaved, drinking my health at dinner without any *mauvaise honte*, and keeping every one alive. Lady Bell is wonderfully well,

and danced in the Haymakers. From her to Rosamond [6] there was a capital gradation of ages. Next week we are to have the Hookers staying with us. He is finishing the printing of an Essay on the 'Flora of Australia,' in which the great question of the mutability of species is treated of, and as he has for years been discussing this great problem with Charles Darwin, and goes nearly as far as he does, I long to read it before I have my say in the new edition of my Manual. Sir James Clark is rather better, but has suffered much. He never missed a birthday dinner of the Prince of Wales before, and the Prince wrote him a very good letter on the occasion, very natural and kind. The Queen has also been very attentive and concerned about him. You should have seen Leonard introduce me to my table of presents. He was as good as an auctioneer. He pronounced a cup and saucer of Sèvres manufacture, much to Lady Bell's amusement, who was the donor, as decidedly the handsomest thing on the table; praised Susan's travelling letter-case as most useful, and so of the rest, informing me who had sent each, which he got up for his own curiosity and my edification, and by no means to show off, for he was unconscious of the amusement he afforded the company.

Believe me your affectionate brother,

CHARLES LYELL.

To DR. JOSEPH HOOKER.

53 Harley Street, London: December 19, 1859.

My dear Hooker,—I have just finished the reading of your splendid Essay [7] on the 'Origin of Species' as illustrated by your wide botanical experience, and think it goes very far to raise the variety-making hypothesis to the rank of a theory, as accounting for the manner in which new species enter the world. Certainly De Candolle's book was like the old doctrine of those who only called in spontaneous generation for explaining those cases where they were unable to trace the origin to an egg or seed. Nevertheless the extent to which he granted nearly half of what he really believed

[6] His young niece of three years old.

[7] Introductory Essay to the Tasmanian Flora.

to be true species to have been derivations in the way of varieties, was calculated to lead philosophical and logical minds to go the whole length of transmutation.

I thought your way of putting it very clear, and the style luminous; the acknowledgment of Robert Brown handsomely done.

The number of grand generalisations is really stupendous when one considers the vast number of species to which they relate. Such as the excess of unstable over stable forms; the limitation of genera and orders owing to extinction, and of species by destruction of varieties; the non-reversion to wild stocks, which struck me as very new and important; the centripetal tendency of hybridisation, species being realities even under the new view. The equality of distribution of the Acot-, Mono-, and Dicotyledons is very wonderful if the dicotyledonous Angiosperms are geologically so modern.

The gymnogens ought, like the marsupial quadrupeds, to have kept some one country to themselves from the oolitic period in order to make the case of plants parallel to that of animals. Though it must be owned that we do not yet know whether in tertiary times there may not have been a rich placental fauna in the Australian area.

The first two notes of page vii. are very interesting, and show what grand speculations and results 'the creation by variation' is capable of suggesting, and one day of establishing.

The facts and views in page xvii. are wonderfully suggestive and grand, as in all about the glacial migrations. The geological chapter is only too short.

I read your Essay when staying with the Van de Weyers, and he ordered it, and will I am sure appreciate it, in a way that few of *our* literary men can.

Ever affectionately yours,

CHARLES LYELL.

To CHARLES BUNBURY, ESQ.

53 Harley Street, London: January 3, 1860.

My dear Bunbury,—I am sorry to hear of your cold, and that you have not been able to get out these fine frosty days.

You asked me whether anything new had turned up about the Bovey Tracey beds. The very day your letter reached me with this query, Pengelly came to town with a fresh store of specimens. Among these the *Glyptostrobus Europæus*, with fruit now, as well as innumerable leaves, was conspicuous. They have come upon another bed in which a large palm-like looking plant, sometimes two or three feet long, and with a somewhat fan-shaped arrangement of the flabellaria-like leaves, abound, but I could find no point from which the leaves radiated, and we had no botanist to help us. We thought it most like one of Heer's plates of *Manicaria*. It is at any rate an outlandish form for Britain.

Did I tell you of Hooker's ascent of Lebanon, 11,000 feet high, and his finding, though now there is no perpetual snow there, old glacier moraines descending 4,000 feet down from the summit, of which he has made some very graphic sketches? All the cedars of Lebanon grow exclusively on these moraines.

Ever affectionately yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

53 Harley Street, London: January 9, 1860.

My dear Ticknor,—I have been so absorbed in preparation for a new edition of my 'Geology' that I have really had no ideas to exchange, except on those matters which the initiated are discussing, or that question which my friend Charles Darwin's book has brought before the British reading public, both scientific, literary, and theological; whether, as Dean Milman expresses it, Lyell and his friend have come from tadpoles, against which the Dean, after reading the book on the 'Origin of Species,' vehemently protests, saying that the production of such a book is in itself enough to refute the possibility of such an origin.

Nevertheless it is easier to say and feel this, than to gainsay the continually increasing body of evidence to which I shall try to add some arguments not yet advanced.

Of all the small books of a readable kind which have

come out in our time, you will find it, I expect, the one which takes the longest to read and digest.

Milman has been much overcome by the sudden death of Macaulay—ten years younger than himself. I wish he were not pall-bearer, as I think it is too much for him. The last time we met him, in July I think, Macaulay was in excellent spirits. It was at Lord Stanhope's. The Duke d'Aumale and Motley were there among others, and there was much talk about the true English origin of most Americanisms. Lord Stanhope is also, I hear, to be a pall-bearer. I have heard nothing positive about the state of Macaulay's historical MS., but the general story runs that one volume at least is finished.

I have been much occupied with another geological subject, besides that which your niece, Ellen Twisleton, irreverently calls, the proving her to be first cousin to a turnip (a violet she should have said). I mean the antiquity of man as implied by the flint hatchets of Amiens, undoubtedly contemporaneous with the mammoth, and also the human skeletons of certain caves near Liége which I believe to be of corresponding age. I regard the Pyramids as things of yesterday in comparison of these relics. I obtained sixty-five recently dug up, and Sir George Grey, of the Cape, and formerly Governor of New Zealand, recognises among them spear-heads like those of Australia, and hatchets and instruments such as the Papuans use for digging up roots, all so like as to confirm the saying you used to quote, of 'Man being a creature of few tricks.'

We hear that the open speaking out against the Government at Vienna forms a remarkable feature to the state of things before the war. The Concordat irritates the low-church party, the army complains that they were not well led in Italy, and the Hungarians are of course more discontented than the German population.

Among the stories I hear is that when the two Emperors took a ride alone after the peace of Villafranca, they went to a rock where there is a famous echo, and Louis Napoleon called out Eugénie, to which the echo replied, 'Génie,' and he proposed to the Austrian to call out the name of his wife Elizabeth, to which the echo answered 'Bête.'

To return to Darwin's book, Twisleton, who has called since I wrote the above, being up here for Lord Macaulay's funeral, told me he had been much taken with the new theory, and stated some objections, and ended with asking me what I thought Agassiz would say to it, after he had nailed his colours to the mast in his recent work on 'Classification.' Now I should like much if you will learn what Agassiz does think and say, and if he has already written anything, please send it to me. Asa Gray, among your scientific men of note, is, I think, the one who comes nearest in his opinions to Darwin. I confess that Agassiz's last work drove me far over into Darwin's camp, or the Lamarckian view, for when he attributed the original of every race of man to an independent starting point, or act of creation, and not satisfied with that, created whole 'nations' at a time, every individual out of 'earth, air, and water' as Hooker styles it, the miracles really became to me so much in the way of S. Antonio of Padua, or that Spanish saint whose name I forget, that I could not help thinking Lamarck must be right, for the rejection of his system led to such license in the cutting of knots. . .

January 10.—Called this morning at Edward Romilly's; all talking of Macaulay's funeral. Edward Romilly said he never heard Macaulay say anything with humour in it. I told him he once, when we were talking of novels, said to me, 'I suppose if you were ever to write one, you would make the lovers meet on the "millstone grit."' E. Romilly declared there was more humour in that than in all he had ever heard him say. As to my flint implements of the age of the mammoth, Macaulay was very clear I must be mistaken. He said they must have got into the drift by some accident.

With love to Mrs. Ticknor and Anna, believe me affectionately yours,

CHARLES LYELL.

To PRINCIPAL DAWSON.

53 Harley Street, London : May 15, 1860.

My dear Dawson,—I ought to have thanked you sooner for your handsome present of 'Archaia,' which I read through with great interest.

I thought some parts very eloquent, but you well know I am one of those who despair of anyone being able to reconcile the modern facts of geology and of many other sciences with the old cosmogonies handed down to us by the unknown authors of the early chapters of Genesis. A great part of your book, however, may be read with no small profit and pleasure, without reference to such matters, and I was glad it was written before Darwin's book came out, and after Agassiz.

You have truly remarked that the latter, by referring varieties and races to separate creations, leads practically to Lamarck's transmutations. Indeed the license in which, in his work on 'Classification,' he indulges in multiplying the miracle of creation whenever he has the slightest difficulty of making out how a bird or a fish could have migrated to some distant point from its first or other habitat, prepared many to embrace Darwin's and Lamarck's hypothesis.

The argument that a plurality of original stocks, demanded by Agassiz, requires more than a sufficient cause, is unanswerable. But Agassiz honestly felt that if he had to allow that the Negro and the European came from one stock, he should go more than half over to the transmutationists. This he candidly confessed in one of his reviews.

Kenrick was the first I remember to argue that the antediluvians who lived five hundred to one thousand years could not have been of one species. Such a difference in regard to longevity would far exceed the other peculiarities of the Negro. If I believed (as I certainly do not) that any race of the genus Homo ever differed from us as much, I should think that a good specific divergence could take place in a much shorter time than Darwin would deem possible.

I by no means deny that progressive development may be inferred from the manner in which the mammalia increase

and rise higher in grade as we trace them down to times nearer our own. Hugh Miller may have pushed it too far, and few allow enough for our ignorance of the ancient inhabitants of the land, yet there is no doubt much truth in the theory of advance, and you ought to have given Darwin credit for not having insisted more upon this class of facts. The truth is that what with occasional proofs of degradation of some types and of persistency without improvement in others, he did not feel justified in going as far as his orthodox opponents. He would otherwise have rejoiced in believing that the rise from the sponge to the cuttlefish, and thence through fish, reptile, and bird to marsupial had occurred, and from that to the intelligence of the Gyrencephala, and from the Chimpanzee to the Bushman, and at length to naked Britons, all by a law of creation ending with the development into an Anglo-Saxon. This successive evolution of sensation, instinct, intelligence, reason, which is such a popular creed with those who shrink from transmutation, is the direct way which leads to Lamarckianism—possibly the road of truth, but they who travel by it hardly I think, see the natural consequences or the goal to which they are approximating. I wish you had shown more appreciation in your review of the number of very distinct sets of phenomena of which Darwin's hypothesis (I claim no higher name for it) offers a solution, and for which no other scientific hypothesis hitherto advanced affords any. With *limited* variability, which is an arbitrary assumption after all, we can explain nothing.

His tables of large and small genera will show you that it is only when you have thousands of species to deal with that you can strike an average, and what you say of Asters will, I think, be denied by botanists.

Hooker's 'Introduction to the Flora of Australia' will interest you much.

Ever most truly yours,

CHARLES LYELL.

To MISS HORNER.

London: June 22, 1860.

Dearest Susan,—I have a promise that 'the bust of the late Mrs. Jameson, by Gibson, R.A., shall be placed in the

corridors to be appropriated to memorial sculpture on the grounds of the Royal Commission of 1851 at South Kensington.'

Also, that if the place for it is not finished or ready, it shall provisionally be put into the room of sculpture.

The Prince wishes, in this and other cases, that there should be inscribed on the pedestal, not only the name, but some statement of the merits of the individual commemorated, which he thinks too much neglected in our public statues, the people requiring instruction.[8]

At first they will put all such statues and busts together as they accept them; but eventually they will be classified, not according to *sex*, but their 'specialities,' as the French would say—historians, poets, artists, &c.

He asked what division Mrs. Jameson would best come into. I said '*belles lettres*, relating to the fine arts;' but that I would consult her friends. At any rate that will be for future arrangement.

You may write to Gibson now.

Yours affectionately,

CHARLES LYELL.

To SIR CHARLES BUNBURY.

53 Harley Street, London, W.: July 4, 1860.

My dear Bunbury,—Baron Anca, a Sicilian, has just found in a cave near Palermo, or rather has just brought to Falconer, remains of the living *Elephas Africanus* in a fossil state, associated with the living African spotted hyæna, and extinct *El. antiquus* and *Hippopotamus Siculus*, all from a cave near Palermo. He brought them to me in this room. They show that Sicily must have been united with Africa, and you perhaps remember that Admiral Smyth discovered that a shallow hundred fathom (?) bottom ran from Tunis to Sicily, while on each side of this submarine ridge there was

[8] Miss Horner modelled a medallion of her friend Mrs. Jameson's head from a cast taken after death, and this aided Mr. Gibson in making the marble bust at Rome which stands in Kensington Museum. The inscription on the pedestal was written by Miss Horner.

very deep sea, a thousand fathom deep on the west side, and never yet fathomed on the east.

Lord Ducie told me a year ago of a hippopotamus having been found in Malta, and the other day at Oxford he showed me a letter from Captain Spratt, giving an account of a cave in Malta in which he had found an elephant (fossil) and a gigantic mole.

Both Anca and Falconer seem to believe that man was contemporaneous with this land connection of Africa and Sicily.

I was not able to attend the section of Zoology and Botany [9] (Henslow in the chair), when first Owen and Huxley, and on a later day the Bishop of Oxford and Huxley, had a spar, and on the latter occasion young Lubbock and Joseph Hooker declared their adhesion to Darwin's theory.

Owen and Huxley discussed the osteological and cerebral distinction of Man and the higher Apes, Huxley contesting seven of Owen's propositions laid down in his lecture at Cambridge as untrue and unsound in fact.

The Bishop of Oxford asked whether Huxley was related by his grandfather's or grandmother's side to an Ape. Huxley replied (I heard several varying versions of this shindy), 'that if he had his choice of an ancestor, whether it should be an ape, or one who having received a scholastic education, should use his logic to mislead an untutored public, and should treat not with argument but with ridicule the facts and reasoning adduced in support of a grave and serious philosophical question, he would not hesitate for a moment to prefer the ape.' Many blamed Huxley for his irreverent freedom; but still more of those I heard talk of it, and among them Falconer, assures me the Vice-Chancellor Jeune (a liberal) declared that the Bishop got no more than he deserved. The Bishop had been much applauded in the section, but before it was over the crowded section (numbers could not get in) were quite turned the other way, especially by Hooker.

Mr. C. Moore interested me much in our section, by the result of a collector's feat which I never heard equalled. He carted away from a fissure near Bristol two tons of the

[9] At the British Association at Oxford.

detritus of the triassic bone-bed which had been accumulated in the said upfilled rent. He had it conveyed to his house twenty miles distant, took two years to examine it, and found in it forty-five thousand teeth of the genus *Acrodus*, counted by the pint measure innumerable other fish and reptiles' teeth and bones, many shells, and nineteen teeth, besides a few vertebræ, of *Microlestes* and two other mammalia genera of triassic age!

I hope to hear soon that you are returning to your scientific reading and investigations, and that you will pay well for what we call 'factorship' in Scotland, rather than let your valuable time be seriously absorbed by such superintendence and agency as can be purchased.

My love to Frances, and believe me affectionately yours,

CHARLES LYELL.

To the REV. CHARLES KINGSLEY.

53 Harley Street, London: September 23, 1860.

My dear Sir,—On my return from the Continent, I find here your excellent sermon on the Prayer for rain, sent to me I presume by your direction, and for which I return you many thanks. Two weeks ago, I happened to remark to a stranger who was sitting next me at a *table d'hôte*, at Rudolstadt in Thuringia, that I feared the rains must have been doing a great deal of mischief. He turned out to be a scientific man from Berlin, and replied, 'I should think they were much needed to replenish the springs after three years of drought.'

I immediately felt that I had made an idle and thoughtless speech. Some thirty years ago I was told at Bonn of two processions of peasants who had climbed to the top of the Petersberg, one composed of vine dressers, who were intending to return thanks for sunshine and pray for its continuance, the others from a corn district, wanting the drought to cease and rain to fall. Each were eager to get possession of the shrine of St. Peter's chapel before the other to secure the saint's good offices, so they came to blows with fists and sticks, much to the amusement of the Protestant heretics at Bonn, who I hope did not by such prayers as you

allude to commit the same solecism occasionally, only less coarsely carried out into action.

Have you read Freeman Clarke on 'Prayer' (Boston, United States), who states more fairly than any author I have read the philosophical difficulty, and, though he cannot clear it away, treats the subject more ably than perhaps anyone has done yet? Horace Bushnell, on 'Nature and the Supernatural' (1859, New York), has also some splendid chapters on the relation of God's free will to the immutable laws of Nature, but the book is very unequal. I hope we shall have the pleasure of seeing you when you are next in town.

Believe me ever truly yours,

CHARLES LYELL.

To the REV. W. S. SYMONDS.

London: October 1, 1860.

My dear Symonds,—I should have written to you a day or two ago had I not been somewhat overwhelmed on my return with arrears of correspondence, and until I had seen Dr. Falconer and learnt whether he and Prestwich had made as much progress as I had hoped on the great question at issue about the relations of certain elephant beds and the glacial epoch. I am disappointed at finding matters so much where they were, here at least, for I hope I see my way rather more clearly in reference to Picardy, Belgium, and the Rhine, where I have been examining both into the question of the antiquity of man, and that of the supposed return of a warmer climate than we have now, after the era of glacial cold.

Some of the evidence relied on for the latter opinion, such as the *Elephas Africanus* in modern drift, has decidedly given way.

My idea of going to South Wales, and taking your district on my way, and getting the benefit of your co-operation, was dependent on some progress having first been made by Prestwich, Falconer, and Colonel Wood in regard to the age of the South Wales caves, with not only *Elephas primigenius*, *Rhinoceros tichorhinus*, but also some of them with the other elephants and rhinoceroses (*E. antiquus*, and *R. leptorhinus*,

now called by Falconer *R. hemitæchus*), the age of these relatively to the glaciers, glaciation, and submergence of North Wales, and the deposition of the northern drift. Interesting as this question is, it is only one of many which I have to go into, such as the new discoveries of human remains coeval with mammoth, Darwin's theory of species, which affects certain passages even of the 'Manual,' and I know not how many other matters which in my travels of the last five years, since the last edition was published, have accumulated upon me, and on which I have to pronounce some opinion. I must therefore stay in town and unpack my boxes, and only thank you heartily for your kind invitation, for which my wife also desires me to send her thanks to you and Mrs. Symonds.

Ever sincerely yours,

CHARLES LYELL.

To PRINCIPAL DAWSON, *Montreal.*

London: October 27, 1860.

My dear Dawson,—I received a letter a few days ago from Sir Charles Bunbury, in which he called my attention to your paper in the February 1859 No. of our Journal, as 'admirable and of great importance, one of the most material additions to our knowledge of vegetable structures in coal that we have had for a long time.' Although I had been much struck with it when it was first read, I had not fully appreciated it till I reperused it in print. The doctrine of the mineral charcoal having been formed by plants decaying in the air is a grand step, and seems to me very unanswerable. What you say also of the Sigillariæ and Calamites, and their not having been of lax and soft tissues but of slow growth, is most interesting; also the number of generations of Sigillariæ in one foot of coal. In short the whole paper teems with grand results, and makes us wish for your continuation in giving us the history of the other seventy-six successive coal-beds of the South Joggins.

Another *Stereognathus ooliticus* jaw has turned up in the Stonesfield slate. An animal about the size of a hedgehog, but I fear we shall learn nothing new from it.

Falconer has made out clearly the former existence of

a small elephant, the size of a Shetland pony, in the small island of Malta. They have also found a hippopotamus there, and a gigantic dormouse the size of a rat, but I fear Falconer's having to go to Sicily for his health will prevent our having a printed announcement of these discoveries.

The African elephant, living species, has turned up in the Sicilian caves, together with the existing Cape hyæna (*H. crocuta* I think it is called), showing the comparatively recent land-connection of Sicily and the African continent, between which there is a very shallow sea 200 or 300 feet deep.

I abandon the Old Red reptile, which will gratify the progressionists, some of whom still feel inclined to adhere to it. The Telerpeton I mean. If Darwin's theory is ever established, it will be by the facts and arguments of the progressionists such as Agassiz, whose development doctrines go three parts of the way, though they don't seem to see it.

Ever most truly yours,
CHARLES LYELL.

To HIS SISTER.

53 Harley Street, London: November 15, 1860.

My dearest Marianne,—I have to thank you for a letter and your good wishes on my birthday, and those of the rest of the family north of the Tweed. Our party[1] went off very pleasantly, as it was sure to do, for we had no one here that we did not like, and scarcely any one of whom I may not say that we were fond, from Rosamond upwards to grandpapa, and Sir Edward Ryan. The impromptu charade of the Catacombs was most entertaining, and the final scene especially. The children, who all acted, were wide awake to the last. I wish you and all of you could have seen them, and the party.

Our new picture, which Susan got for us at Dresden,[2] and of which I presume you heard, was much admired.

[1] On his birthday.

[2] A copy of the Madonna di San Sisto.

Both Gibson the sculptor and Boxall the painter admire it as a copy exceedingly.

The other day Mr. Wollaston, the entomologist, told me that he had just received some insects, Coleoptera, from St. Helena. Not only the species but the genera so entirely different from all the rest of the world. He said, when we were talking of the extinctions fast going on, that the large Copper, *Lycæna dispar*, is believed to be fairly blotted out of creation. It was only British, and you saw what they had done to Whittlesea Mere. I hope our specimens are in good preservation, for what with their beauty and rarity, they are getting up to a fabulous price, which shows how they are valued. I am sorry I did not find time when last at Drumkilbo to go over the Coleoptera and Lepidoptera at least. Some of the St. Helena Curculionidæ seem to be the most abnormal types.

I have just got Bunsen's 'Egypt's Place in Universal History' from Mudie's, and am much interested in it. Max Müller's Essay on 'Comparative Mythology' in the Oxford Essays for 1856 is a splendid article.

It was like old times again to meet the Heads[3] at the Milmans', but the loss of their son makes a great blank. There was no young man of all my acquaintance as able and enthusiastic as a geologist. The Heads will return in February to Canada, but I hope for no long time. Joseph Hooker is expected this week to return from Syria. Faraday was calling here to-day, to explain why he could not romp with the boys as he did last year. He is very well, and going to lecture at Christmas, and Leonard is to hear him. With love to all,

Believe me affectionately yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

53 Harley Street, London November 29, 1860.

My dear Ticknor,—I was glad to get the news in Mrs. Ticknor's last letter of the opening of the Museum and of Agassiz's doings. I fully expect it will soon be a model

[3] Sir Edmund Head, Governor-General of Canada, and Lady Head.

collection. I shall be curious to see a second reply of Agassiz to Darwin, which I understand is coming. Murray has sold all that remained, and more, of my friend's 'Origin of Species;' 4,250 copies printed, and only out about a year, and he must now prepare a new edition.

Whatever faith we may settle down into, opinions can never go back exactly to what they were before Darwin came out. The Oxford Professor of Geology, J. Phillips, has fought Darwin by citing me in pages out of my 'Principles,' but I must modify what I said in a new edition. Agassiz helped Darwin and the Lamarckians by going so far in his 'Classification,' not hesitating to call in the creative power to make new species out of nothing whenever the slightest difficulty occurs of making out how a variety got to some distant part of the globe. Asa Gray's articles, all of which I have procured, appear to me the ablest, and on the whole grappling with the subject, both as a naturalist and metaphysician, better than anyone else on either side of the Atlantic.

I have been very busy with the proofs afforded by the flint implements found in the drift of the valley of the Somme at Amiens and Abbeville, and more recently in the valley of the Seine at Paris, of the high antiquity of man. That the human race goes back to the time of the mammoth and rhinoceros (Siberian) and not a few other extinct mammalia is perfectly clear, and when the physical geography was different—I presume when England was joined to France.

This will give time for the formation of many races from one, and enable us to dispense with the separate creation of several distinct starting-points, to make up for unorthodox conclusions about 'preadamite man,' of which I see some writers are freely talking. How are you getting on with your 'Life of Prescott'? faster I hope than I am with my new edition of my 'Geology.' I am afraid there is no chance of Baron Bunsen's recovery; but when we saw him two months ago he was full of vigour and animation. His date of 10,000 years B.C. for Noah's flood must astonish some of the orthodox in Boston. This reminds me of Max Müller's Essay on 'Comparative Mythology' in the Oxford Essays for

1856, which appears to me in the philological part very excellent. The argument for the existence of some aborigine language, whether it be called Arian or by any other name, seems conclusive, and it must go a far way back, as they branched off into such distant and ancient nations. Bunsen's testimony that there is no tradition of the Arian deluge in Egyptian history and mythology is striking.

Ever affectionately yours,

CHARLES LYELL.

November 30.—The newspaper to-day brings the news of Bunsen's death. I was not prepared for it so soon. He was so beloved by his family, that it will be a great blow.

CHAPTER XXXV.

APRIL 1861—DECEMBER 1862.

EXCURSION TO BEDFORD, WHERE FLINT IMPLEMENTS HAD BEEN FOUND—OFFER OF CANDIDATURE OF M.P. FOR UNIVERSITY OF LONDON—KREUTZNACH—FOSSIL BOTANY—MEETING AT PHILOSOPHICAL CLUB—DEATH OF PRINCE ALBERT—LETTER ON THE PRINCE CONSORT—ANNIVERSARY DINNER AT GEOLOGICAL SOCIETY—CURTIS, THE ENTOMOLOGIST.

[Various offers of a flattering kind were made to him at different times to accept offices; a Trusteeship of the British Museum, President of the Royal Society, &c.: and during the year 1861, under the proposed Reform Bill for a representative in Parliament for the University of London, the candidature was offered to Sir Charles Lyell. But he declined all, and resolved that he would devote himself to the end of his life to his favourite science, which was daily opening up more interesting matter for study and research. The first symptoms of ill-health declared themselves in this year, and he was advised to spend some weeks in Kissingen in Bavaria, whither he went in June, accompanied by his wife and nephew.

In January 1862 he was elected Corresponding Member of the Institute of France. This year was saddened by the death of his wife's mother at Florence, whither he and Lady Lyell went in May, and later in the year they visited various places on the south coast of England.

In 1863 he visited the Caves of Liége and Maestricht, and in the autumn made a tour in Wales, accompanied by the Rev. W. S. Symonds.

The 'Antiquity of Man' was published in February of this year. An order of scientific merit was conferred on him by the King of Prussia, the present Emperor. The order was instituted by the former King (Frederick William IV.) and Alexander von Humboldt was its first chancellor.]

CORRESPONDENCE.

To Sir Charles Bunbury.

London: April 26, 1861.

My dear Bunbury,—I am laid up for a day or two after an excursion to Bedford with Prestwich and Evans, to see a section where a Mr. Wyatt, editor of the Bedford provincial newspaper, has just found two fine hatchets of the true Amiens and Hoxne type. They occurred in working a gravel pit at Beddingham, which I visited more than thirty years ago, when I stayed with Admiral Smyth, then residing at Bedford. That part of the pit, twenty-five feet deep and of large extent, which I then explored, is a wood of tall larches which have grown fast and do credit to the interval.

As the hatchets occurred at the bottom of the old fluviatile gravel which contains Cyclas, Lymnæa, Helix, &c., of recent species, they prove that man was in the country before any mammalia of which the bones are buried in said gravel. I saw a specimen of *Elephas antiquus* found in the town of Bedford at the same level as the *E. primigenius* of Beddingham. At the latter place is also the tichorhine rhinoceros. I was assured that the hippopotamus major was also found in another locality; but I will not answer for that, but am prepared for anything after my last visit to Paris and revisit to Abbeville. For I am now prepared to believe that all the animals above mentioned were in the country after man, and by digging a pit myself at Abbeville, I obtained five implements below a fluvio-marine bed containing the *Cyrena fluminalis*, alias *C. consobrina* of the Nile. The relation of man to the close of the glacial period is a point on which I have not yet made up my mind, but I suspect those beds in France may have begun before the northern drift of England was finished. The late discoveries at Herne Bay and Reculvers convince me that man inhabited England when the Thames was a tributary of the Rhine.

But enough of these very modern affairs. What you tell me of those plants of more respectable antiquity, and of Lesquereux's observations,[1] interest me much. I am surprised

[1] On the Coal-plants of Pennsylvania.

that he can make out, even by the omission of some conspicuous plants, any kind of resemblance between the American swamps and European peat mosses, except by going very far north in the Transatlantic Continent. No doubt all the coal-plants of Europe and America have been formed in very analogous habitations. Dawson tells me that he has found such a number of different species of Trigonocarpum in that part of the Nova Scotia coal, where there is a similar abundance and variety of Sigillaria, and where Coniferæ are scarce, and has found so many Trigonocarpa in hollow Sigillariæ, that he is half inclined to guess that said fruits belong to said genus.

Ever affectionately yours,

CHARLES LYELL.

To HIS BROTHER.

53 Harley Street, London : April 23, 1861.

My dear Tom,—Under the new or proposed Reform Bill, the University of London, with a constituency of about 700, is to have a member, and a strong party, wishing to have a new literary or scientific element introduced into the House, as representing academical interests, offered to bring forward Mr. Grote, formerly M.P., but being now immersed in finishing his 'History of Greece,' he declined about a fortnight ago, and they then offered it to me.

I was obliged to consider the affair just as if the Bill was carried, and as if (which I really believe) the committee could carry me. I declined, though there is no place in the House I would so soon hold ; and as the party who made the offer are by no means the extreme Liberals, I should have fully sympathised in their political as well as educational views. But my happiness is in carrying on my Geology, and I believe I shall do more good in that line, as I have on hand years of unpublished travels, and reading, and thinking. There is a great demand for a new edition of the 'Manual,' now out of print, and the ninth edition of the 'Principles' (5,000 copies) nearly exhausted. I have also a new book on the stocks.

We don't talk of the overture, as I would not cheapen

the honour. After all, will Lord John carry his Bill? They (the University of Edinburgh) offered me a degree at Lord Brougham's installation, but I grudged being absent five days from town, but was half sorry to refuse to go. Here is enough about myself in all conscience.

Believe me your affectionate brother,

CHARLES LYELL.

To HIS SISTER.

Frankfort: June 17, 1861.

My dearest Eleanor,—We were talking of you yesterday when we stopped at the railway station at Kreutznach, and wishing you were there again, and in as fine weather as we have been having ever since we left England. Leonard and I have been making out the geology as we flew along over the Low Countries, and then spent two days among the limestone caves of the Meuse at Dinant above Namur, and then through the forest of Ardennes, which still deserves that name between Namur and Luxembourg. I went from the last place to Saarbruck to see the finest collection of plants of the coal which perhaps exists in Germany, and the finest of insects of the same early period, chiefly fossil *blattæ* and *termites* (cockroaches and white ants), of which the Professor has collected more than thirty individuals. I liked the look of Kreutznach. Did any of you ever take a trip to Oberstein to see the agates there? I should like to have stopped a day there. We are to go for at least a three weeks' stay to Kissingen.

With love, ever your affectionate brother,

CHARLES LYELL.

To the DUKE OF ARGYLL.

53 Harley Street, London: July 9, 1861.

My dear Duke of Argyll,—I write to say that I have invited Professor Heer of Zurich, the best botanist in Europe for fossil tertiary plants, to come here in the autumn—August and September—to determine the Bovey coal-plants which have been collected by Mr. Pengelly at the expense of Miss Burdett-Coutts.

Heer is particularly desirous of examining the Mull plants, because he thinks they will form a link between the Miocene plants of Bovey Tracey, Switzerland, and the fossils of the surtebrand of Iceland, which Heer has lately worked upon. Among other wonderful discoveries they find the tulip-tree (*Liriodendron*) in that now cold and treeless island, and Heer thinks that Scotland in the Miocene period may have supported a similar flora.

If you can do anything, whether by new researches or by placing at Heer's disposal any stores already accumulated of the plant-bearing beds, it is a fine opportunity of having them thoroughly examined by a first-rate authority.

He will detect species where they might evade the search of any other naturalist, having so practised an eye. His work now finished on the 'Flora Tertiaria Helvetica' is a beautiful and most satisfactory one.

Believe me most truly yours,

CHARLES LYELL.

To LEONARD LYELL.

Folkestone: August 7, 1861.

My dear Leonard,[2]—If you visit Clova, or make out some other expedition, I hope you will write me an account of it. I was glad to hear you had found *Ancylus fluviatilis*. I met with it lately fossil in France, in great numbers, in gravel in which two species of extinct elephants and a rhinoceros had been met with. The gravel was laid open in a railway cutting on the banks of the river Oise.

Naturalists used to wonder how this *Ancylus* got spread over the country in separated lakes and streams, till some one found a young *Ancylus* adhering to the elytra of one of those large boat-beetles, *Dytiscus marginalis*, which you will see in the collection at Drumkilbo,[3] and which fly about at night from pond to pond, and may sometimes carry the *Ancylus* with them, if, like the *Patella* which you saw high and dry on the rocks here, he can manage to do without water for an hour or two, as most probably he can.

Tell mamma we gathered samphire in flower at the

[2] His young nephew of ten years old, who was in Scotland.

[3] The country house of Sir Charles's sisters.

Lyddon Spout yesterday, and many other marine plants, and wished she and you had been with us, as Mr. Bentham named all the plants for us, and gave us much botanical information. But we were so busy with the plants and with five miles of walking, that we had no time for fossils, and when we reached the gault it was almost dark. The tide was lower than when you were there with me.

Tell Uncle Tom that Mr. Powrie has been to Arbroath, and has written to say that he finds that he was mistaken, and not I, about the position of certain beds of conglomerate and purplish shale which he, Mr. Powrie, said in a paper read to the Geological Society, were not as I had represented them during a visit I made to the spot forty years ago. It is an interesting place, and I hope some day to examine it with you, but I must not wait another forty years, unless I intend to rival the Countess of Desmond,

> Who lived to the age of a hundred and ten,
> And was killed by a fall from a cherry-tree then.

I believe Aunt Mary told mamma about a letter of Mr. Darwin's, wanting Mr. Bentham to tell him how to get from Tenby in Wales a variety of *Orchis pyramidalis*, which you remember gathering here, 'without spurs,' which mamma one day pointed out to me as so characteristic of the flowers of that plant. The first specimen which Mr. Bentham gathered in the Warren when talking with me of C. Darwin's letter, was this very variety and monstrosity. But though we have picked two or three dozen since, not one of them departed from the usual type, and I fear they are all gone off now, which is a pity, as Darwin has written to me for another without spurs. But I shall try again if the rain will but stop. Yesterday we had a splendid day, the French coast very clear.

Give my love to Frank and Arthur and Rosamond.

Believe me, my dear Leonard,

Your affectionate uncle,

CHARLES LYELL.

To Sir Charles Bunbury.

London: August 26, 1861.

My dear Bunbury,—I wrote some time ago to Heer of Zürich, asking him, if he had any copies by him of his 'Fossil Flora of Switzerland,' to bring one with him to London in September, for that you wished to buy it. I begged him at the same time to bring, if possible, a copy for both you and me, of a beautiful French translation which I know Gaudin was making of the grand Essay on the 'Swiss Tertiaries' as compared to those of other countries, and on climate, all treated from a botanical point of view. In this translation Heer himself has added some valuable pages here and there on Aix-la-Chapelle plants of Debey, on Œninghen insects, &c. It would make a good 8vo. volume. All the rest of the book, the description of the plants, &c., does very well in German, but this theoretical portion, which is very well done, it is a luxury to have in French. Gaudin has also added some chapters to which his name is appended.

Heer has sent me a report on the Bovey coal-plants. They had only made out about fifteen species, and now that Pengelly has, at my suggestion, sent over the collection to Zürich, Heer finds forty-five species. I see he has named a *Lastræa, L. Bunburii.* It is Lower Miocene. A great or rather abundant *Sequoia,* allied to the Californian mammoth tree, forms the bulk of the coal, cones and seeds in plenty. *Sequoia Couttsiæ* is named in honour of the lady at whose expense the collection was made. There are palms (palmacites); cinnamons, two species; *Nymphæa, Proteaceæ, Quercus,* two vines; *Ficus,* two species; *Gardenia.* I quote from memory, having had to send on the letter to Pengelly the same day I got it. Fifteen species identical with continental Lower Miocene; many new species. I expect Heer here in a week, and he will go to Bovey Tracey, and I daresay find more species.

Ever affectionately yours,

Charles Lyell.

To PROFESSOR HEER.[4]

53 Harley Street, London: August 26, 1861.

My dear Professor Heer,—The day I received your letter I sent it to Mr. Pengelly, and I have this morning heard from him. He is as much delighted at the importance of your results as I am, and he is more surprised, for I always felt sure that you would find twice or thrice as many species as they had dreamt of.

I am extremely gratified by the compliment which you and M. Gaudin have had the kindness to pay me in your dedication to me of the translation of your splendid essay, which I am reading in French with renewed pleasure and admiration. When I first received the copy, I did not see that the dedication was there, and so acknowledged the parcel in my letter to M. Gaudin without any special allusion to this very flattering testimony of your esteem. I hope the new edition will be approved of by you. I have gone much farther than before in favour of a progressive development, and have also endeavoured to show the importance of botany in geological classification.

Believe me most truly yours,

CHARLES LYELL.

To LEONARD HORNER, ESQ.

53 Harley Street London: November 5, 1861.

My dear Horner,—We had a good meeting of the Philosophical Club, eighteen present. Sabine in the chair in great force. Grove, Williamson, Miller of King's College, Sharpey, Carpenter, Daubeny, Falconer, Frankland, Gassiot, Hooker, Huxley, Bence Jones, Partridge, Sykes, Tyndall, Wheatstone. Tyndall gave an account of an attempt he had made to measure the heat of the moon's beams by an instrument on the roof of the Royal Institution, and he found in a clear sky, that the moon when the instrument was turned to it produced a chill. Melloni had found heat, but he

[4] Professor Oswald Heer, of the Technological Institute of Zürich, eminent fossil botanist, author of the *Urwelt der Schweitz*, and other important works.

found cold; he supposed there was watery vapour in the air, acted on by the heat of the moon. Grove and Miller discussed it, but could make little of the fact theoretically. At last Sharpey said that in controverting Tyndall's hypothesis, they seemed to forget that his having ascertained the fact was a great point, and they owed him thanks, although his own expectations had been

Quenched in the chaste beams of the watery moon.

With this happy quotation, which produced quite a burst of applause, the matter ended, and Huxley gave an account of the Neander-thal cranium, and asked what he should call it. Some one suggested 'an anthropoid,' which he has adopted since, in talking with me about it. I was asked to give some idea of the age of said skull, and of Lartet's Aurignac cave, which I did.

Ever affectionately yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

53 Harley Street, London: November 10, 1861.

My dear Ticknor,—Milman was much pleased, when I called one day, to show me a couple of handsome volumes, the last of the series of eight of his 'Latin Christianity,' which had come out in the United States (New York, I think), since the war began. When people express surprise at such things, I remind them that everything went on here much as usual when we were in the worst of the Crimean War. I hope you read the Duke of Argyll on the 'American War,' the best speech I think of all, in or out of the Cabinet.

I like what I see of Adams, the new Minister here of the United States. But he must have much to put up with, if it were only the ignorance of American affairs shown by the questions put to him. If, says Mr. Adams, the questioners were not politicians it would be more excusable. He, the Minister, cannot pay visits, as the only time he went out of town for two days, he was telegraphed back again, so constant are the arrivals of news, and so numerous the points which he has to give answers about. The forfeiture of

merchant vessels because they have a one-sixteenth of their cargo belonging to Southern States, was the last affair I heard of, many Americans not daring to leave London and Liverpool, and wanting to learn from Adams what is the force and construction of some late Act of Congress.

I suppose you have read the memoir of De Tocqueville. I never met him except that morning at Lord Stanhope's when you were last here, when I thought him most agreeable and conversationally eloquent.

Remember me to all your circle.

Ever affectionately yours, CHARLES LYELL.

To LEONARD HORNER, ESQ.

Barton: December 26, 1861.

My dear Horner,—You were mourning like us the loss we have sustained by Prince Albert's death.[5] It was many days before I could fully realise it. I went down the day of the evening he died, and at four o'clock, just as the illness took its fatal turn, I found a bulletin at the Palace which led us to hope that the danger was nearly over. I hardly think I ever saw a family where there was more domestic happiness and good understanding between husband and wife, and father and children. As to the reserve with which he was charged, I can only say that to me, and I am sure to a multitude of others, he was remarkably open, and talked of all subjects, even the most serious, without fear of committing himself. Though I have spoken with him often since then, the last time I had a full hour's talk, *tête-à-tête*, I owe to Susan's asking me to arrange the affair of Mrs. Jameson's bust. That was soon settled, and he went into Educational, Exhibitional, British Museum, and other subjects, and did not mind speaking of his disappointment when he had been overruled, and listened when I did not quite agree with him as to the British Museum with patience, and like one who wished to look at the matter on all sides. I know of no public man in England who was so serious on religious matters, and so unfettered by that formalism and political churchism and conventionalism which rules in our upper classes.

[5] Mr. Horner was spending the winter in Florence with his family.

The only point I ever remember distinctly differing from him, so that the subject was afterwards avoided, was Hungary. As to Germany he went quite as far as I do in his liberalism, but he could not help looking upon Hungary from a German point of view, though I believe he thought of the folly of Austria, with her Concordat, &c., much as I do.

Having seen his marriage, and the eldest children when they were hardly out of the nursery at Balmoral, and then the *fêtes* at the marriage of his daughter, and now his death as a grandfather, and having felt myself so far advanced in my own career when I first knew him, I cannot think of his being gone without seeming all at once much aged myself. The regular meeting of the Geological Society was put off because of this death.

As to my new book,[6] I get on very steadily and with pleasure to myself. I am now treating of the relations of the earlier history of man to the glacial period—a difficult subject, especially as I have to connect it with some new views respecting the glacial hypothesis, both as relates to Scandinavia, Scotland, and the Alps. I have deferred what I am to say on Darwin to the last or eighteenth chapter, knowing that were I once to begin there is no chance of coming out this year, but if all is ready but that, I may have courage to abridge it into one short chapter.

Believe me yours affectionately,

CHARLES LYELL.

To JOHN MURRAY, ESQ., *Albemarle Street.*

January 2, 1862.

My dear Sir,—I was at Sir Charles Bunbury's in the country, or I should have replied sooner.

The late Prince Consort certainly deserves the most eloquent *éloge* that one of your best writers can give him in the 'Quarterly.' He was always thinking of what could be done to improve the nation morally and socially, and in the fine arts, and how popular education, and that of the higher classes, could be advanced.

[6] On the *Antiquity of Man.*

I believe it was a common idea that he was too reserved, but he was very much the reverse. I am sure that not a few can affirm that he talked most freely and without restraint on a great variety of subjects on which many public men would have been somewhat afraid of committing themselves. He was certainly very careful, as became a man in his position, to avoid personalities, but he spoke out his opinions fearlessly, often on the most speculative as well as on practical subjects, and always listened patiently to what one had to say on the other side.

The quantity of work he got through, in spite of innumerable interruptions, was immense. His foreign correspondence alone, which the public here knew nothing of, would have been thought sufficient occupation for one who had nothing else to do. I remember on two occasions when he was called upon to write addresses, one as President of the British Association, and one again for the Social Science meeting, that he told me they taxed him rather too much, as his other engagements were so numerous, and many of them requiring much thought. He told me there was an unusual pressure upon him when he had to compose his British Association Address for Aberdeen, and that he felt strongly he had not done justice to it. Once when I requested him to attend a meeting of the Geological Society, he looked at his note-book, and I was astonished at the number of Wednesdays in advance that he already had engagements for, and on my expressing surprise, he showed me that it would have been the same had we met on any other day of the week. A very large proportion of these had reference to some useful object, or were connected with the duties of his station.

He had no special acquaintance with geology or mineralogy, or so far as I know with any branch of natural history, but he knew enough of all to be interested in them, and to understand what their cultivators were about. How much he desired to encourage them, and how much he wished that the elements of these branches of knowledge should enter more largely into the system of education in this country, is well known.

When I first knew him, about fifteen years ago, I found

that he had read my 'First Travels in North America' with some attention, and he referred more than once to what I had said on educational matters. He was then very sanguine of the progress that might be made in his own time in the diffusion of popular education. Twelve or thirteen years later he was equally zealous in the cause, but expressed his disappointment that 'all that we of the present generation in this country can hope, is to teach those who will educate the generation that is to follow.' Alluding to my citation of what Liebig had said to Faraday on the different relative value set by the Germans and English on the practical in science, and the purely theoretical, or discovery of new truths or principles ('First Travels,' vol. i. p. 309), he said he believed Liebig had justly estimated the character of the two nations, and that both might in this respect learn from the other.

He often alluded to the want of cultivation of the German language amongst the higher class, and the number of diplomatists who had been sent to German Courts, and even important embassies, who knew little or nothing of the language of the people. It is well known how much he tried to remedy this by giving prizes at Eton, &c. When first the excellence and originality of his speeches and addresses on various occasions attracted attention, it was very commonly asked, who wrote them for him? When I declared to some who put this question, that I was convinced he got no help from anyone in the way of ideas or opinions, only now and then some passages were put out of the German into the English idiom by friends (and this only in early days), I found people very incredulous. It seemed to me that for years he was underrated, at least that his great talents were not duly appreciated, and that his character was not understood.

I think the best tribute to his memory would be to collect all his speeches, and to make in your Review a judicious set of extracts. There would be much life in them, and some of the best will be found in newspapers, and not separately printed. There was a very good one I am told at a Royal Academy dinner which I missed.

I never made any notes of conversations which I had

with the Prince, but I have a vivid recollection of many, which I have never repeated to anyone, thinking it would be a breach of confidence.

I believe it was Sir James Mackintosh who said that a biography to be worth anything ought never to have been written, and I feel much the same in regard to such a letter as would really answer the object you have in view.

CHARLES LYELL.

To LEONARD HORNER, ESQ.

53 Harley Street, London : February 23, 1862.

My dear Horner,—I must send you a few words on the anniversary, which went off very well. Murchison read your letter, which was well received, and he then delivered an appropriate complimentary address to Godwin Austen on presenting the medals. Austen, who was remarkably gratified by the honour, replied at length, and said he should work much harder in future. The chairman then gave a biographical account of the late Dr. Fitton, which he had got up with much pains, and which was a just tribute to one who had taken so active a part in the Society as well as in our science. After which, Huxley delivered a brilliant critical discourse on what paleontology has and has not done, and proved the value of negative evidence, how much the progressive development system has been pushed too far, how little can be said in favour of Owen's more generalised types when we go back to the vertebrata and invertebrata of remote ages, the persistency of many forms high and low throughout time, how little we know of the beginning of life upon the earth, how often events called contemporaneous in Geology are applied to things which instead of coinciding in time, may have happened ten million of years apart, &c. &c., and a masterly sketch comparing the past and present and almost every class in zoology, and something of botany cited from Hooker, which he said he had done because it was useful to look into the cellars and see how much gold there was there, and whether the quantity of bullion justified such an enormous circulation of paper. I never remember an address listened to

with such interest or received with such applause, though there were many private protests against some of his bold opinions.

The dinner at Willis's was well attended; I should think eighty or more present. The Duke of Argyll made an excellent speech on proposing Ramsay's health. Monckton Milnes made a happy and humorous speech in reply to 'Members of the House of Commons.' I was requested to give the 'Universities,' which I coupled with Dr. Williams, Principal of Jesus College, with whom we stayed at Oxford, who spoke fluently in reply. Lord Ducie, Sir Philip Egerton, Sir H. James, most of the Council, and a full representation of Jermyn Street were there. The Duke of Argyll having talked of Scotland as a specific centre from which so many geologists had come, Warrington Smyth stood up for other centres of creation south of the Tweed, and late in the evening Huxley made them merry by a sort of mock-modest speech. I sat between Charles Bunbury and Dr. Williams, and had a pleasant time of it, and was pleased to think how much life there is coming on in the Society, when all of us who are above sixty are added to the extinct organisms.

Ever affectionately yours,

CHARLES LYELL.

To HIS SISTER.

53 Harley Street: March 7, 1862.

My dearest Caroline,—I do not wonder that you thought Curtis was dead, for really when I called after more than a year and a half, I wondered whether I should find that he was still surviving the mischief which the three cabs, all of which had passed over different parts of his body, had done him. I was shown in, and though quite blind found him looking well, wearing a handsome grey beard. . . . I found Curtis up to all that is going on in entomology, and envying the luck of a friend who lives near the great Lowestoft lighthouse, where the moths come by thousands so as to darken the light, and require to be swept away, some of them crossing from the Continent, and not being British species. Enough indeed to make an old blind collector's

mouth water. Then he told me how the 'Glory of Kent,' *Bombyx versicolor*, which once cost 2*l.* 2*s.*, could now be had for 3*s.* 6*d.*, and other gossip of that sort. By the way, some day as I pass a dealer opposite the British Museum I will send you the said 'Glory.' So much for getting blind when near seventy, and having three cabs go over one.

Your affectionate brother,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

Freshwater Gate, Isle of Wight: August 20, 1862.

My dear Darwin,—Mr. Jamieson of Ellon has been again to Lochaber, and confirms his former theory of the glacier lakes. The chief new point is a supposed rise at the rate of a foot per mile of the shelves as we proceed from the sea inland. It seems to me to require many more measurements, before we can rely on it. He found some splendid moraines opposite the mouth of Glen Trieg. He found some shells of Arctic character in the forty feet high raised beach of the Argyllshire coast, and has asked me to learn about one of them, of which he sends a drawing.

I fell in yesterday in my walk with Mr. A. G. More, whom you cite in your orchid book. He considers you the most profound of reasoners, to which I made no objection, only being amused at remembering that, such being the case, you had performed a singular feat, as the Bishop of Oxford assured me, of producing 'the most illogical book ever written.'

We shall be here for a week longer. I have been with my nephew Leonard to Alum and Compton Bays.

Ever most truly yours,

CHARLES LYELL.

To LADY BUNBURY.

53 Harley Street: November 16, 1862.

My dear Frances,—The so-called gorilla which is going the rounds of the newspapers is a fine male chimpanzee, still at Liverpool. They told me to-day at the Zoological Gardens that some years ago there was a real live gorilla at

Liverpool which lived eight months and was mistaken for a chimpanzee, but they stuffed him and the mistake was afterwards detected. So the present hoax is a sort of compensation.

The Marquis d'Azeglio told me this morning that the ibex or bouquetin of which, as well as of the chamois, the King of Sardinia has sent a pair to the Gardens, is only a hybrid between the ibex and goat. It had been spoken of as of pure breed.

Mary and I saw Bishop Colenso yesterday, who is a very gentlemanlike and intellectual style of man.

I have to give evidence to-morrow before the Public School Commission—Lord Clarendon in the chair—recommending two hours a week on science and natural history, as an encroachment on Latin verses and translating Addison into Greek prose, to which the other forty hours must be devoted.

November 20.—I missed the Geological yesterday, and shall not go to Owen's paper on the 'Paleornis' to-night at the Royal, nor to a dinner at the Rich's, nor to one which Katharine has invited me to, but in spite of every denial of the kind, I move slowly on. This last week an interesting examination by the Commissioners of Public Schools, in which they wished to have my opinion as to the feasibility of introducing the elements of natural history and physical science (two hours a week only) into Eton, Winchester, Harrow, &c., stirred me up a good deal and did not benefit me in my progress in my book.

Ever affectionately yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

53 Harley Street, London: December 19, 1862.

My dear Ticknor,—I was glad to hear that you had at last determined to bring out your 'Life' or 'Memoir of Prescott' without waiting for the end of the war, which may possibly be deferred, not to the Greek kalends, for I don't think the South will hold out two years, but for a time so uncertain that it is better not to delay it. I should much have liked

it to have come out when people were less excited by battles and such vital questions as the emancipation of the slaves. People are beginning, I think, to estimate the financial resources of the North and the real wealth of the country better than they were. If the result of the struggle could be the abolition of slavery by the year 1900, it would be worth a heavy debt and many lives, at any rate when one thinks of what most wars are waged for, not but that the Union alone is worth a long fighting for. The distress in Lancashire is increasing, and I suppose we must have parliamentary aid. The cotton we get from India so raises the price that they (the Indians) suffer severely, and their native manufactures are knocked up.

The Milmans are well. He getting out a new edition of his 'History of the Jews,' and will reply to George Cornewall Lewis, who makes out the Egyptians so modern, and says they were never a conquering people. Surely he never could have seen the processions of captives and the sieges on the temples.

Bishop Colenso on the 'Pentateuch' is making as much noise this year as did the 'Essays and Reviews' last year. If people had read what Norton, or the Germans, or our William Greg in his 'Creed of Christendom,' have said so well, there could be no sensation created by such a book. But the policy is well sustained, never to reply to any lay attack, as it only draws it into notice. But if a churchman enters the lists, Convocation and meetings of the clergy, and the 'Record' and other intolerant papers, set to work advertising the delinquent publication, as if they were bribed by Longman, who sold 10,000 copies of Colenso the first day (price 6*s.*) and is going on since pretty steadily. The decision on the case of the 'Essays and Reviews' has left churchmen very free on most points which they were afraid to venture on for fear of legal penalties. One thing affirmed by Colenso is universally admitted, that the strictness of the ordination vows is preventing the young men of both Universities of most talent and the finest moral sense from entering the Church.

Believe me ever affectionately yours,

CHARLES LYELL.

CHAPTER XXXVI.

MARCH 1863—AUGUST 1863.

ON TRANSMUTATION OF SPECIES—LAMARCK—VISIT TO OSBORNE—MUSEUM OF THE YOUNG PRINCES—INTERESTING CONVERSATION WITH THE QUEEN—'ANTIQUITY OF MAN'—WELWITSCHIA—EXPEDITION TO WALES—MOEL TRYFAEN.

CORRESPONDENCE.

To Dr. Joseph Hooker.

London: March 9, 1863.

My dear Hooker,—Darwin has sent me a useful set of corrigenda and criticisms for the new edition I am busy in preparing.[1] He seems much disappointed that I do not go farther with him, or do not speak out more. I can only say that I have spoken out to the full extent of my present convictions, and even beyond my state of *feeling* as to man's unbroken descent from the brutes, and I find I am half converting not a few who were in arms against Darwin, and are even now against Huxley.

I feel that Darwin and Huxley deify secondary causes too much. They think they have got farther into the domain of the 'unknowable' than they have by the aid of variation and natural selection.

Asa Gray says that Lyell's doctrine is 'that the thing that is, is the thing that has been, and shall be.' Now if tne thing that is, in the case of a man of genius born of ordinary parents and with ordinary brethren of the same parentage imply a slight leap, I do not see why Darwin should complain of my leap, given only as a speculation, from the highest unprogressive to the lowest progressive.

However, I plead guilty to going farther in my reasoning

[1] *Antiquity of Man.*

towards transmutation than in my sentiments and imagination, and perhaps for that very reason I shall lead more people on to Darwin and you, than one who, being born later, like Lubbock, has comparatively little to abandon of old and long cherished ideas, which constituted the charm to me of the theoretical part of the science in my earlier days, when I believed with Pascal in the theory, as Hallam terms it, of 'the archangel ruined.'

Monday evening.—On my return home to dinner I find your letter. I have not time to reply, but thank you much.

As the glacial chapters are of course not the most popular, I am the more pleased that you and Darwin like them.

I see you coincide with Darwin, and not with Crawfurd and others, who tell me they are so glad 'I did not lay down transmutation dogmatically as proved, though I have evidently come nearly quite round to it.'

I don't care what people have been expecting as to the extent to which I may go with Darwin, but certainly I do not wish to be inconsistent with myself. Though, as I have been gradually changing my opinion, I do not want to insist on others going round at once. When I read again certain chapters of the 'Principles,' I am always in danger of shaking some of my confidence in the new doctrine, but am brought back again on reconsidering such essays as Darwin's, Wallace's, and yours. I see too many difficulties to be in the danger of many new converts who outrun their teacher in faith.

I have not had time to profit fully by your valuable letter, but shall do so, and beg you to write freely if you have not said all in the way of criticism. I have heaps of approving letters, but few are able and willing to help one by such comments as yours and Darwin's.

Believe me ever sincerely yours,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

53 Harley Street: March 11, 1863.

My dear Darwin,—I see the 'Saturday Review' calls my book 'Lyell's Trilogy on the Antiquity of Man, Ice, and Darwin.'

As to my having the authority you suppose to lead a public who up to this time have regarded me as the advocate of the other side (as in the 'Principles') you much overrate my influence. In the new 'Year Book of Facts' for 1863, of Timbs, you will see my portrait, and a sketch of my career, and how I am the champion of anti-transmutation. I find myself after reasoning through a whole chapter in favour of man's coming from the animals, relapsing to my old views whenever I read again a few pages of the 'Principles,' or yearn for fossil types of intermediate grade. Truly I ought to be charitable to Sedgwick and others. Hundreds who have bought my book in the hope that I should demolish heresy, will be awfully confounded and disappointed. As it is, they will at best say with Crawfurd, who still stands out, 'You have put the case with such moderation that one cannot complain.' But when he read Huxley, he was up in arms again.

My feelings, however, more than any thought about policy or expediency, prevent me from dogmatising as to the descent of man from the brutes, which, though I am prepared to accept it, takes away much of the charm from my speculations on the past relating to such matters.

I cannot admit that my leap at p. 505,[2] which makes you 'groan,' is more than a legitimate deduction from 'the thing that is' applied to 'the thing that has been,' as Asa Gray would say, and I have only put it moderately, and as a speculation.

I cannot go Huxley's length in thinking that natural selection and variation account for so much, and not so far as you, if I take some passages of your book separately.

I think the old 'creation' is almost as much required as ever, but of course it takes a new form if Lamarck's views improved by yours are adopted.

What I am anxious to effect is to avoid positive inconsistencies in different parts of my book, owing probably to the old trains of thought, the old ruts, interfering with the new course.

But you ought to be satisfied, as I shall bring hundreds

[2] See *Antiquity of Man*, first edition, p. 505.

towards you, who if I treated the matter more dogmatically would have rebelled.

I have spoken out to the utmost extent of my tether, so far as my reason goes, and farther than my imagination and sentiment can follow, which I suppose has caused occasional incongruities.

Woodward is the best arguer I have met with against natural selection and variation. He puts conchological difficulties against it very forcibly. He is at the same time an out-and-out progressionist.

I am glad that both you and Hooker like the 'ice' part of the Trilogy. You are the first to allude to my remarks on Ramsay, who says 'I shall come round to his views in good time.'

Falconer, whom I referred to oftener than to any other author, says I have not done justice to the part he took in resuscitating the cave question, and says he shall come out with a separate paper to prove this. I offered to alter anything in the new edition, but this he declined. Pray write any criticism that occurs to you; you cannot put them too strongly or plainly.

Ever yours sincerely,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

53 Harley Street: March 15, 1863.

My dear Darwin,—Your letter will be very useful. I wish to get such passages so far in the Darwinian direction as not to be inconsistent with my general tone, and what Hooker calls some of my original arguments in favour of natural selection. At the same time I am struck by the number of compliments, both in reviews and in conversation with the half-converted, which I receive, because I have left them to draw their own inferences, and have not told them dogmatically that they must turn round with me. Hooker admits that in science people do not like to be told too plainly that they must believe, though in religion they wish to have it laid down for them. Yet he may be wrong, for if the 'Times' were to write for the next fortnight against

the Southern States, and against the Poles, nine-tenths of good society would whirl round, and the middle class which would stand firm would be able to do so partly because they read cheaper papers which are not interested in following the lead of the 'Times.' . . . .

I wish I deserved what you say about taking criticism kindly. I often think I should be as touchy as anyone if the success of my works did not give me a constant opportunity of profiting immediately by every suggestion as to style and moral tone, and above all as to facts and logic. Besides the increased responsibility which I incur by the trusting public, who before they had read a word induced the trade to bid for 3,850 copies, I have the prospect, if I improve my knowledge and my teaching, of future success in new editions with comparatively little labour.

As to Lamarck I find that Grove, who has been reading him, is wonderfully struck with his book. I remember that it was the conclusion he came to about man that fortified me thirty years ago against the great impression which his arguments at first made on my mind, all the greater because Constant Prévost, a pupil of Cuvier's forty years ago, told me his conviction 'that Cuvier thought species not real, but that science could not advance without assuming that they were so.' When I came to the conclusion that after all Lamarck was going to be shown to be right, that we must 'go the whole orang,' I re-read his book, and remembering when it was written, I felt I had done him injustice.

Even as to man's gradual acquisition of more and more ideas, and then of speech slowly as the ideas multiplied, and then his persecution of the beings most nearly allied and competing with him—all this is very Darwinian.

The substitution of the variety-making power for 'volition,' 'muscular action,' &c. (and in plants even volition was not called in) is in some respects only a change of names. Call a new variety a new creation, one may say of the former as of the latter, what you say when you observe that the creationist explains nothing, and only affirms 'it is so because it is so.'

Lamarck's belief in the slow changes in the organic and inorganic world in the year 1800, was surely above the

standard of his times, and he was right about progression in the main, though you have vastly advanced that doctrine. As to Owen in his Aye Aye paper, he seems to me a disciple of Pouchet, who converted him at Rouen to 'spontaneous generation.'

Have I not at p. 412 put the vast distinction between you and Lamarck as to 'necessary progression' strongly enough?

Huxley's second thousand[3] is going off well. If he had leisure like you and me;—and the vigour and logic of the lectures, and his address to the Geological Society, and half a dozen other recent works (letters to the 'Times' on Darwin, &c.), been all in one book, what a position he would occupy! I entreated him not to undertake the 'Natural History Review' before it began. The responsibility all falls on the man of chief energy and talent; it is a quarterly mischief, and will end in knocking him up.

I am sorry you have to go to Malvern. The good of the water-cure is abstinence from work; a tour abroad would do it, I am persuaded, as effectually and more profitably.

I hope my long letter will not task you too much; when I sit down to write to you, I can never stop. Hooker, not having heard from you, is growing anxious, and hopes it is because you are corresponding with me and not because of serious ill-health.

Ever affectionately yours,

CHARLES LYELL.

To LADY LYELL.

Osborne: May 6, 1863.

My dearest Mary,—At Southampton I found a Queen's Messenger, and on the way to the docks fell in with Lord Stanley of Alderley, who had come down by the same train, bound for Osborne. At the docks in a room there, Sir James Clark was waiting, having only arrived ten minutes before me. He had hired a nice open carriage, and given me the offer to go on in the 'Elfin' steam yacht with Lord Stanley to Osborne, or with him to Netley. I chose the latter, and

[3] *Lectures to Working Men.*

after a pleasant drive of some five or six miles after crossing the Itchen ferry in a steamboat, we saw the Abbey, and then went over the Military Hospital, an immense building for about 1,000 invalid soldiers, with four or five Professors of Medicine and Surgery, Museum, &c. Most of the patients are soldiers who have served in the East Indies, and it must be good practice for the young medical students from twenty to twenty-four years old to attend here on those who have Indian complaints of the liver, &c., just what they will find when they get out to India. A lecture was being delivered by one Professor, another showed me a collection of skulls for ethnology presented by army surgeons, another pointed out to me numerous bones with gunshot wounds, &c. After two hours there, and seeing geological specimens and Bracklesham fossils from an artesian well (*Cardita planecostata*, *Fusus longevus*), 180 feet deep, which they have dug, we left.

It is a beautiful site near the sea, this Netley Hospital, on a deep and extensive bed of gravel, and all the newspaper stories of its being in a bog were inventions. The colonel who commands assured me they are never annoyed at low tide by the smell of the mud.

We had expected the 'Elfin' to return from Osborne to take us up at the Hospital, but Prince Leopold's tutor and Prince Alfred's had got hold of her to go on board the great ironclad and ram ship of war the 'Resistance,' and we received a message to take the Southampton packet. So we started in a boat with good sailors sent from the 'Elfin,' and glad I was of my cloak, for we were for an hour tossing about off Calshot Castle. Both the Southampton boat and the 'Elfin' came in sight from opposite quarters at last, and it was twenty minutes before we knew which we should take. At last we got into the 'Elfin' which took us to the 'Resistance,' but the Prince's party had not done their inspection, and the 'Elfin' took us to the pier at Osborne, and Sir James and I landed and walked with our small bags through the pleasant grounds to the house, which we reached at half-past five o'clock, and we got a cup of tea. Dr. Lyon Playfair has been here for a day, but has left. I believe from what Sir James tells me, that I shall not get back till Saturday, but in good time.

It has been a heavenly day, or the toss in the boat, which I by no means suffered from, might have been very disagreeable. Had there been mist, it would have been an unpleasant adventure. We saw the outside of the great ram, the 'Resistance,' famously.

My love to all. Believe me ever yours affectionately,

CHARLES LYELL.

To LADY LYELL.

Osborne: May 7, 1863.

My dearest Mary,—After I wrote to you Becker came to my sitting-room, which opens into the bed-room, commanding a pleasant view of the park with the trees in their fresh green foliage, as forward or more so than in London. He took me down to the dining-room, where I was introduced by Sir T. Biddulph to his wife and to Lady Mount-Edgcumbe, now in waiting, and her young daughter of eighteen on a visit. Colonel Cowell, whom I talked with, you remember, on a former occasion about his visit to the Dead Sea, was also in the drawing-room, and we sat together at the dining-table, and he told me of a late visit to St. Vincent in the West Indies —the pitch lake of Trinidad, &c. Some fifteen in all sat down to dinner, and were very merry.

Latish in the evening, when cards were playing at the table, Lady Augusta Bruce came in, and asked me after you, and had a long talk about American affairs, on which she is very enlightened, though leaning to the opinion that for the sake of the world (*i.e.* England), a separation might be better; but I think I modified her views.

The Queen's open carriage and four, with herself and Princess Alice, is just driving past my window for Cowes, where she is to visit the Prince of Leiningen.

The secretary, Mr. Ruland, was at breakfast this morning, and the same party as at dinner yesterday, except the Postmaster-General. Sir C. Phipps talked to me with great admiration of Arthur Stanley, and showed me an excellent photograph of him. I am going to take a quiet read, and then walk for an hour before luncheon with Sir James Clark, if not stopped by a thunderstorm which is threatening. I

have just finished Milman's preface, which is excellent, and have lent it to Sir J. Clark.

Three o'clock.—I only got a short walk in the garden with Sir James Clark when the Prince of Hesse sent for me, and as I entered the Princess Alice received me, and said she remembered me since Balmoral days, and introduced me to her husband. Her manners are very charming, and she talked most freely on all subjects. He has really read me as far as the end of glacial chapters with attention. They had been discussing the time it would take for all the existing races to have come from one original pair. Arthur Stanley is evidently a very great favourite with the Princess. I had about half an hour's talk with them, and then retired to luncheon, having promised at four o'clock to go to the Swiss Cottage with Prince Louis to see the collection, which consists partly of objects brought home by his brother-in-law Prince Alfred, who he said wished to join us.

Ruland the secretary is here, so the Germans muster strong. When the Prince of Hesse wanted a word in English, he asked his wife in German to help him.

Becker is reading one of Mudie's copies of my book, lent him by Colonel Elphinstone. The Princess Alice said I should give her a copy of the second edition, as I had done to her sister. I believe I am to see the Queen before we go to the Swiss Cottage.

Geikie's book on the 'Glacial Period in Scotland' is very well done, and may enable me to make the 'Elements' a little different from the 'Antiquity,' in which last, however, there is nothing wrong, or discordant with Geikie's facts and arguments touching glacial matters.

Seven o'clock.—The Queen sent for me before four o'clock, and talked with me alone for an hour and a quarter. Mostly about Prince Albert, leading me also to talk of him. Arthur Stanley recommended her to read my 'Antiquity.' She asked me a good deal about the Darwinian theory as well as antiquity of man. She has a clear understanding, and thinks quite fearlessly for herself, and yet very modestly. Nothing could be more natural or touching than her admiration for the Prince. She said that for one who had so much enjoyment in the present, which he found wherever

he was, it was remarkable that he was cheerful whenever he had to change place or business. If they were at Balmoral or Osborne, and were called to Windsor, he not only went, but never allowed himself to be put out. As soon as we had done talking over books, &c., I went to the Swiss Cottage, where the Prince of Hesse and Prince Alfred were waiting. The last showed me all over the museum—silicified woods from Antigua brought home by himself, a very nice collection; a collection of Portland stone fossils, tertiary shells, a few of which he said I gave him when last at Osborne, stuffed birds which he or the Prince of Wales had shot in Canada and elsewhere, &c.

The Princess Helena and her next sister joined us at the museum. I then started with Becker and Ruland on a geological walk along the seaside, and in our way, fell in first with the Queen driving Princess Alice in a pony car. They went alone without any servant to the seaside, called a boat, and took a row afterwards. Prince Alfred took a boat and rowed the Prince of Hesse out to the Queen's boat. He had no sailor to help him. In our walk we fell in with Miss Hilliard and Princess Beatrice, who asked us to come to a small miniature fort constructed in the grounds by Prince Alfred, with a moat and rampart and drawbridge. Here she played all sorts of pranks with Becker, who barked as a dog, and got into a small miniature barrack, and then shut her up in it, and so on. She has wonderful spirits.

The weather is charming, but the gardeners and farmers are in despair at the drought. They fear there will be no hay.

I hope our aunts are arrived. My visit here has been a very agreeable one thus far. I am made to feel so very welcome.

I hope to hear from you this evening or to-morrow morning, my dearest love.

Princess Alice asked me after you and where I had left you. Ever your affectionate husband,

CHARLES LYELL.

To Lady Lyell.

Osborne: May 8, 1863.

My dearest Mary,—Sir James and I leave this at ten o'clock to-morrow morning. Yesterday we had Mr. Elliot to dinner, who says the Greeks are settling down, and getting reconciled with the new scheme. He describes the enthusiasm for Prince Arthur as having been very great, 'the son of the widow,' as they called him. Only 100 voted for a republic, but their doing so freely was an advantage, as showing that they were at liberty to choose.

I have been with Becker this morning over Prince Alfred's museum, and find there is less disorder than I thought—some rubbish to be thrown away of course, but most of it is very fairly grouped. We went over the kitchen in the Swiss Cottage, in which the Royal children cook all sorts of things, quite a large *batterie de cuisine*, and they invite Becker and others to come and eat the products.

When the Swiss Cottage, in part of which the gardener lives, was built, the boys used to work two or three hours a day in earnest with the labourers, and got certificates of work done from the foreman, and sent in a regular bill, which the Prince Consort paid exactly according to the then rate of wages, to give them an idea of such things.

Then we went over the tool-house, the initials of every child on each watering-pot, wheelbarrow, &c.; then over the separate garden-plots belonging to each, from the Princess Royal's down to Princess Beatrice's, each of equal size. No great variety, because, if one of the elder ones chose to have a row of potatoes, and of strawberries, and of currants, &c., each of the others imitated. The flowers do not take up a fourth of the whole. I came in and read for some time, and then set out on a second walk with Sir James Clark, to a kind of steward's house, older than the Palace, once a monastery, with a great variety of shrubs, and a holly with a larger trunk than I ever remember seeing. The *Erica arborea*, now in flower, flourishes exceedingly in the garden. *Weigelia rosea*, I think, is the name of a splendid flowering shrub which Fortune brought twelve years ago from Shanghai

in China. It is in great beauty here, standing the drought well.

30*th*.—The Queen has just started with Lady Mount-Edgcumbe and Sir James Clark to see Netley Hospital. It is almost the first time she has proposed anything of the kind, and they are all glad she is going. I take for granted that Princess Alice has also gone, but I did not hear.

The Queen has always dined privately with her own family, and will I suppose do so to-day.

A most beautiful small aneroid, not bigger than a very large pocket watch, has come down from Negretti, for the Queen to measure heights with at Balmoral. They have a fine telescope for star-gazing, and the night I arrived, saw Jupiter and his satellites, which I only heard about to-day. At every turn one meets the hand of the Prince Consort.

Six o'clock.—I have been walking with Becker and Ruland to the meteorological observatory, where there is a regular clerk of the works. For twelve years self-registering instruments for measuring the force and direction of the wind (to-day it is NNE.), and the fall of rain, and the temperature, degree of moisture, quantity of ozone in the air, barometric observations, &c., all printed monthly. These we inspected, and then out along the wooded walks near the sea; the wild furze and broom, hyacinths, some primroses in beauty.

Seven o'clock.—Sir James has just returned from Netley, where the Queen walked over the spacious Hospital till poor Lady Mount-Edgcumbe was knocked up. The Queen is actually taking a drive in the grounds after all the inspection and yachting. I received your letter this morning. I was glad to hear of the arrival of our aunts, and hope to see them soon after you get this.

Dearest love, your affectionate husband,

CHARLES LYELL.

Sir James has his *congé*, and we go to-morrow at ten o'clock. The Queen has sent word that she is to see me to-night to take leave.

To His Sister.

53 Harley Street, London: May 12, 1863.

My dearest Marianne,—I am in your, and I believe everybody's debt in the way of letters, Caroline I believe for one, whose account of the comparison of *Lycæna dispar* and its foreign variety I was glad to have. The English entomologists declare that no one can deceive them by trying to pass off a foreign specimen as British upon them. I have got a fine specimen of the American variety of the common Admiral, or *Vanessa Atalanta*, which I mention in my book, and which I will send when you are at Drumkilbo again, for at present none of you would have time or heart to enter on a comparison of the European and American races, which look so like and yet are always distinguishable.

I am busy to-day thinking what I am to say to-morrow at a great meeting of the Literary Fund, Lord Stanhope in the chair; having this morning got positive intelligence that I shall have to reply to a toast on the 'Writers on Science.' There is always a great muster of authors, and a good many ladies. I have paid ten guineas as my subscription towards the fund for distressed authors, besides a guinea for the dinner, as I am one of the stewards. I have felt it right as a 'successful author' to contribute to the unsuccessful, and believe it is really very well managed.

I daresay Mary and Katharine will have told you my Osborne news. It was a great satisfaction to have a good long talk quite alone with the Queen for an hour and a quarter, and about one for whom I had such a regard, and for whom I felt, though it would not be etiquette to say so, such real friendship, as I did for the late Prince Albert. I do not think she has given way more than is perfectly natural—all necessary duties she has performed. The quantity of work thrown on her now is great. I told her that when the Social Science people pressed the Prince to be their President, he told me the anniversary address would be a severe addition to his work. No one of his speeches was more difficult, or, I think, better done, especially on the connection of science and religion, so difficult a question for a public man to deal with. She said

this address, and the thinking out the whole subject thoroughly, as he always did, was one of the things which overtasked him. She said he was always cheerful and determined to think everything for the best, a short life, among other things, of which he had sometimes a slight presentiment, in spite of his good health. She has of course been reading many serious books, and I asked her if she had read what Sir Benjamin Brodie has said about death. She said she had, and was much struck with his observing that if we knew what those we had loved were doing in another world, or if we even knew the exact time of our own death, it would alter the whole complexion of our lives, and probably make us perform our duties less well in this life.

I had a talk with Princess Alice and her husband separately in their room on another occasion, and another evening a long conversation with the Queen, Prince and Princess of Hesse, and Prince Alfred—very cheerful, about books and things in general. One morning I had a walk with the Prince of Hesse and Prince Alfred, and no one else, and Prince Alfred showed me over the museum in the garden, in which are all the birds stuffed which he and the Prince of Wales had shot in different countries. A fine set of half-polished silicified woods of various kinds—palms, exogenous wood from Antigua, fossil shells from Portland, Isle of Wight, &c. He showed me a few Isle of Wight fossils I had given him, named years ago, which I had forgotten. I was introduced to Princess Helena by Prince Alfred, when she looked in at the museum.

The dinner party included none of the Royal family, and were most of them well known to me; Sir C. Phipps, Sir T. Biddulph, Colonel Cowell, Sir J. Clark, Lady Augusta Bruce, two German ladies-in-waiting on Princess Alice whom I had not seen before, Lady Mount-Edgcumbe and a very agreeable daughter, and some others—a very merry party.

I have only as yet seen the Princess of Wales at a distance, but on the 19th inst. Mary and I are asked to a reception at St. James's Palace, which they are to have for the Queen. The Queen asked me about the success of my new book, about which I find Canon Stanley had spoken to

her, which had led her to request a copy from me. I had taken down a copy of the second edition, thinking that it might be useful, and Princess Alice asked me for one, and told me I should dedicate it to her. Her husband had actually read steadily through the Queen's copy as far as near the end of the glacial chapters.

I got some time for reading when I was at Osborne, and went over the meteorological observatory, which is first-rate, and the records of wind, rain, electricity, &c. &c., all kept by self-registering instruments, and well kept, and published monthly.

I went to Osborne on Wednesday and returned Saturday. The 'Fairy' brought us back, Sir James Clark and me, in grand style from the pier at Osborne between ten and eleven o'clock, and then by fast train we went to town.

The Royal Academy dinner this year was a brilliant affair, and I was glad to have a good talk with Kinglake, author of 'Crimean War,' who sat next me. Lord Palmerston's speech also was very entertaining and lively. There is a pleasant French article on my book in the 'Revue des deux Mondes,' by Laugel.

The Queen told me that her sons had asked her if the Colenso whose Arithmetic they had studied was the Bishop, and had remarked 'Then he must be very clever.' I told her that my nephew Arthur had said, 'I don't like Colenso; he gives me hard sums to do.' She laughed, and asking his age said, 'All mine were older.'

Believe me ever your affectionate brother,

CHARLES LYELL.

To THOMAS S. SPEDDING, ESQ.

53 Harley Street: May 19, 1863.

My dear Spedding,[4]—I was very glad to hear from you, and to know that you had been reading my book, which has met with great success, having as Mudie told Murray a few days ago, divided the reading world, so far as his library is a test, with Kinglake. We have sold nearly 5,000 copies. I wonder I have been let off with so little serious antagonism;

[4] T. S. Spedding, Esq., of Mirehouse, Keswick.

only a few indignant remonstrances on the part of the 'Record' and some of the Church reviews for ignoring the Bible, and writing just as if I had never heard of such a book, and could take for granted that the scientific readers were as indifferent as myself at the irreconcilability of my pretended facts and reasonings with Scriptural truths.

The question of the origin of species gave much to think of, and you may well believe that it cost me a struggle to renounce my old creed. One of Darwin's reviewers put the alternative strongly by asking 'whether we are to believe that man is modified mud or modified monkey.' The mud is a great come-down from the 'archangel ruined.' Even in ten years I expect, if I live, to hear of great progress made in regard to 'fossil man.'

I am in hopes that the struggle in America will rid the country in the course of twenty years of that great curse to the whites, slave labour, and if so, it may be worth all it will cost in blood and treasure. My New England friends do not despair, though indignant at the mismanagement at head-quarters.

Believe me ever most truly yours,

CHARLES LYELL.

To the REV. W. S. SYMONDS.

Barton Hall, Bury St. Edmunds: June 23, 1863.

My dear Symonds,—Since I wrote to you our plans have been somewhat more matured (and I write again, as I forget what day I told you we should probably leave town and journey towards South Wales). I propose to go on the 14th straight to the inn near Gower Point, from which I see by Murray's book that tourists see the caves of the Gower peninsula, those caves which Dr. Falconer and Colonel Wood have lately been examining, and shall try and form an opinion as to the relation of the extinct animals to the raised beach and to the glacial drift of South Wales.

My next point is the Cefn caves near St. Asaph, in the north-east of Wales, examined by Trimmer, Ramsay, and Falconer. I have a letter from Ramsay about them. They are best calculated in North Wales to throw light on the

relative age of the extinct mammalia and the glacial drift, and in their neighbourhood Captain Thomas showed Ramsay drift with shells.

My other point is Moel Tryfaen, and the shells found at great heights by Trimmer and Ramsay near the Menai Straits. Not that I may succeed in seeing the shells, for they are very rare, but Ramsay has given me the name of a guide who can show me the drift and region where they have been found.

As it is only an hour or two by rail to Holyhead, I may go there. I hope to see a peat moss out of which Mr. Stanley, M.P. has dug two specimens of mammoth sent to the British Museum. He has invited me to see the spot.

You were good enough to suggest some months ago that, if the time suited, you might be able to accompany me on my tour. If you could, whether for a part or the whole of the three weeks' run, I should be very glad.

You said in one of your letters that there will be many who will go soon to Wales to see whether the enormous changes of level in Post Pliocene times at present inferred from the glacial and other phenomena are legitimate speculations. Even a brief glance of some of the ground will I am sure enable me better to judge than a great deal of reading, or will at least qualify me to read critically what has been said by others.

Believe me ever sincerely yours,

CHARLES LYELL.

To SIR CHARLES BUNBURY.

Pendock Rectory: July 19, 1863.

My dear Bunbury,—We are enjoying beautiful weather and a splendid view of the Malvern Hills from our windows, having yesterday had a fine drive through the vale of Evesham to Tewkesbury, and then here. I examined Strickland's Cropthorn beds, and found at the level of the elephants and *Cyrena fluminialis* what *may* be a 'core' from which flint knives were struck off, but perhaps Evans may say of it, as of certain prismatic flints of the elephant bed of Ickling-ham, that they are natural and not artificial productions.

He (Evans) has promised to go to Icklingham in the summer, and to call on Mr. Prigg and try and make out the question of the old trenches which contain tools.

My visit to Charbes and Saint-Prest and the Paris museums has satisfied me of ice-action in the time of *Elephas meridionalis*, and as to Desnoyer's proofs of 'pre-glacial man,' and horns and bones cut and scraped and broken by man, at the period of the Cromer forest bed. They are certainly very curious, not to be pooh-poohed, and yet tantalising because one wants more evidence. *À propos* to the same Cromer bed, King has just written to me to say that he has found the rhizomas of *Osmunda regalis*. I should like to know your opinion of the kind of evidence on which he relies so confidently. He says 'the rhizomas are so large that they must have risen like tree-ferns two or three feet out of the ground.' Mr. Symonds has got a specimen containing, in one small fragment of rock, two or three seeds representing the oldest known plants with the oldest yet known Silurian fish, which he tells me he is to give you for your museum.

With love to Frances, ever affectionately yours,

CHARLES LYELL.

To DR. JOSEPH HOOKER.

London: July 31, 1863.

My dear Hooker,—I have been reading the paper on 'Welwitschia' with as much pleasure and profit as one so ignorant of botanical details of structure can do. I am glad you threw out a few hints on its bearing on the development theory. It is a splendid anomaly, and had it been carboniferous instead of a living plant, would have afforded Agassiz a fine illustration of his favourite theme, that in the earliest periods adult organisms were what afterwards were only exemplified in the embryonic stages of more highly organised creatures, animal and vegetable.

I have been with my wife and nephew Leonard geologising for two days between London and Rochester. We found primroses in flower.

The Welwitschia would be enough for one year's work,

though a mere episode in yours. The illustrations most telling. Ever sincerely yours,

CHARLES LYELL.

To LEONARD LYELL.

53 Harley Street : August 23, 1863.

My dear Leonard,—I have been a long time answering your letter, and have now to report that I went yesterday to Mr. King's, whose shop is much improved, and bought three-pennyworth of *Anacharis*, as you wished, which Aunt Mary has put into the aquarium, when she counted the fish and other creatures mentioned in your letter, and found the number agree with your list, besides the small fry.

I have been driving to-day all round Battersea Park, which is now beautified with flowers. Miles of Tom Thumb geraniums, blue lobelias, yellow and other calceolarias, and a background of dahlias. Some day I hope to take you to see it.

Aunt Mary and I went over Victoria Park the other day, where there is a greater extent of ground, with an equally splendid display of flowers, and with a long piece of water on which were boats let out to hire and much used.

I suppose you heard that Aunt Mary and I had a very pleasant tour in Wales. On a hill called Moel Tryfaen, at a height of 1,300 feet above the sea, I found twenty species of fossil shells, all of living species, in sand and gravel fifty feet thick. You would have known most of them familiarly, for there was the common cockle, whelk, eatable mussel, *Mya truncata*, the common turritella, and others, but with them *Tellina proxima*, *Natica clausa*, *Mangelia pyramidella*, and other northern species. On the whole an arctic fauna like Spitzbergen. I have mentioned this hill in my last book, and the shells, but only twelve were known before—found some thirty-five years ago, and as Charles Darwin could find none, the fact was disputed by some. Luckily a new mining company wanting to get roofing slates, had spent 150*l.* in laying open this section just in time for me to see it. Next year probably it will all be closed up again, but not I hope till forty species have been found.

These shells show that Snowdon and all the highest hills which are in the neighbourhood of Moel Tryfaen were mere islands in the sea at a comparatively late period, or when these living European mollusks were flourishing.

I had a good view of Colonel H. Bunbury's place, Abergwynant, the day I rode up to the top of the mountain called Cader Idris. July is often a rainy month in Wales, but this year we had constant fine weather. The sportsmen who came to fish complained of the want of rain, as the salmon could not get water enough to ascend the rivers, and were jumping in the sea in swarms off the coast of Aberystwith.

With my love to Frank, Arthur, Rosamond, and papa and mamma, believe me, my dear Leonard,

Ever your affectionate uncle,

CHARLES LYELL.

CHAPTER XXXVII.

FEBRUARY 1864—NOVEMBER 1865.

SCHEME FOR CAVE-EXPLORATIONS IN BORNEO—DUKE OF ARGYLL ON 'VARIATION OF SPECIES'—BERLIN—THE CROWN PRINCESS—CROLL ON 'CHANGE OF CLIMATE DURING GEOLOGICAL EPOCHS'—EARTH-PYRAMIDS AT BOTZEN—HEER'S 'URWELT DER SCHWEIZ'—LETTER TO MR. SPEDDING ON THE 'AMERICAN WAR'—SIR JOHN HERSCHEL'S DRAWINGS OF THE EARTH-PILLARS.

[In the beginning of 1864 his father-in-law, Mr. Leonard Horner, died, in his eightieth year. In April Sir Charles and Lady Lyell made an excursion to Midhurst (where he had been at school) and went on to Salisbury to see its valuable Archæological Museum.

He was elected President of the British Association, which held its thirty-fourth anniversary at Bath, where he dwelt in his Address at length on the thermal springs of that place, and having spoken on the phenomena of glaciers, he alluded to the antiquity of man, a subject which was beginning to attract general attention.

This year he was made a Baronet.

He spent the Christmas of 1864–5 in Berlin, with his brother-in-law Chevalier Pertz, and in the summer of 1865 he and Lady Lyell, accompanied by their nephew Leonard Lyell, revisited the Alps, and went to the earth-pyramids of Botzen and the Glacier Lake of Aletsch.

Through the greater part of his life, he had suffered from weak sight, and therefore was frequently read to, and he dictated much of what he wrote. During his last ten years, he had the benefit of a very efficient secretary, a lady [1] gifted with a rare intellectual power. From her daily intercourse with one who never failed to inspire all those who were with him with a love of his science, she acquired an extensive acquaintance with the subject, which has since enabled her to popularise the study of natural science among young people.]

[1] Miss Arabella Buckley, author of a *Short History of Natural Science*; the *Fairy Land of Science*; and *Life and her Children*.

CORRESPONDENCE.

To W. Pengelly, Esq.

53 Harley Street: February 12, 1864.

My dear Sir,—Mr. Alfred Wallace, whom you know by name, told me the other day that there are limestone caves in Borneo, within reach of Rajah Brooke's jurisdiction, which deserve more than any in the whole world to be explored, as he feels sure they must contain the bones of extinct species of anthropomorphous apes most nearly allied to man, just as the Australian caves afford us fossil species of extinct kangaroos and other marsupials. He proposed to me to get the Royal Society to make a grant for the exploration of some one of these caves, and asked if I knew anyone prepared to undertake it, and could be sure that Sir James Brooke would encourage the exploration, if I would do my best. Do you not sometimes meet Sir James at Miss Coutts's, or is he not somewhere at Torquay? No one could better explain than you the peculiar interest of such an inquiry, and if I could get Wallace into correspondence with him, we might perhaps find some adventurer with competent knowledge to undertake the enterprise and get the scheme into such shape as to enable us to appeal to the Royal and Geographical Societies, and perhaps get up a private subscription in aid of the object. It is precisely the kind of investigation which no surveyor sent out to find gold or tin or coal, or other products of economical value, would be justified in following up, or even giving to it a small portion of his time, and you well know how much time and patience it would require.

Believe me, my dear sir,

Ever most truly yours,

Charles Lyell.

To George Ticknor, Esq.

53 Harley Street, London: April 28, 1864.

My dear Ticknor,—When I last wrote to you I had only read the first half of your 'Life of Prescott,' and if I admired and enjoyed it exceedingly, you may well believe

that the last half interested me still more, for while I think its merit as a biography is equally great, it had the additional charm to me of embracing the time when I knew Prescott personally, and so many of his friends. It was like living over again those years which we spent in America, which we always look back upon as among the happiest of our lives.

I was very much struck with the skill you have shown in making Prescott tell his own story, and yet omitting those parts of his memoranda and letters which would have diluted the tale. As it stands, it is very racy and pithy.

I am to-day going to meet Sir James Brooke, the Rajah of Sarawak, and Mr. Ricketts, the first consul appointed by the Government here to that new region, which has so suddenly started into commercial importance, for the sake of organising a scheme for exploring some caverns of limestone in the Rajah's dominions, from which they have hitherto got nothing but eatable birds' nests. But I feel persuaded that on examining the floor, deeply covered with guano or the dung of countless bats or vampires, they will find fossil bones; and as we have obtained extinct kangaroos and other marsupials from the Australian caves, and extinct forms of armadillo, sloths, and American monkeys from the caves of Brazil, so I hope to get extinct ourangs, if not the missing link itself, from these Borneo explorations. Miss Coutts is a great friend of the Rajah, and we are all to meet at her house. She thoroughly enters into the spirit of the undertaking. If we can only get a few bones by a preliminary *reconnaissance*, by aid of the Rajah's officers and dyaks, we should easily raise funds here for larger excavations.

Ever affectionately yours,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

53 Harley Street, London: November 4, 1864.

My dear Darwin,—I was delighted to hear yesterday at the Athenæum that the Council had decided that you were to have the Copley medal, for when it was not awarded to you last year I felt that its value had been much lowered,

and in my indignation at the want of courage implied in their hesitation, I sympathised with a friend who has long held that these medals do more harm than good, which, however, I have always been unwilling to believe.[2]

In the present instance it is of more than usual importance, not in a purely scientific point of view, for your reputation cannot be the least raised by it in the minds of those whose opinions you care for, or who are capable of judging for themselves as to the merits of such a book as the 'Origin,' but because an honour openly conferred by an old chartered institution acts on the outsiders and helps to increase that stock of moral courage which is so small still, though it has grown sensibly in the last few years. Huxley alarmed me by telling me a few days ago that some of the older members of the Council were afraid of crowning anything so unorthodox as the 'Origin.' But if they were so, they had the good sense to draw in their horns.

Believe me ever affectionately yours,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

Magdeburg : January 16, 1865.

My dear Darwin,—I was so busy with the last chapters of my new edition of the 'Elements' before I left town a month ago, that I did not reply to your kind letter about my after-dinner speech on your Copley medal at the Royal Society anniversary. I have some notes of it, and hope one day to run over it with you, especially as it was somewhat of a confession of faith as to the 'Origin.' I said I had been forced to give up my old faith without thoroughly seeing my way to a new one. But I think you would have been satisfied with the length I went. The Duke of Argyll expresses in his address to the Edinburgh Royal Society very much what I have done ('Antiquity of Man,' p. 469), that variation or natural selection cannot be confounded with the creational law without such a deification of them as exaggerates their influence. He seems to me to have put the difficulty pretty clearly, but on the other hand he has not brought out as

[2] [It will be observed this does not apply to the late awards of the medals.]

fully as I should have liked him to have done, the great body of evidence so admirably brought to bear in your work, in proof of the bond of mutual descent, and the manner in which species and genera branched from common ancestors. He did not entertain this idea till he had read your book, and he is now evidently impressed with it, as I am; and he would, I think, go the whole length, were it not for the necessity of admitting, in order to be consistent, that man and the quadrumana came from a common stock. He does, indeed, in defiance of consistency, admit for the humming-birds what he will not admit for the *primates*, and Guizot's theology is introduced to support him; but the address is a great step towards your views—far greater, I believe, than it seems when read merely with reference to criticisms and objections. The reasoning about materialism appears to me admirably put, and his definition of the various senses in which we use the term 'law'; though, having only read the speech once, I am not yet able to judge critically on all these points. He assumes far too confidently that the colours of the humming-birds are for mere ornament and beauty. I can conceive a meaning in your sense for the advantage of the creature, or of its friends and enemies, in every coloured ray of light reflected from the plumes. We must indeed know far more than we do before we can dogmatise on the irrelevancy of particular colours to the well-being of a species. He ought also to define beauty, and tell us whether it is in reference to man or bird. I have no objection to the idea of beauty or variety for its own sake, but to assume it so positively is unphilosophical.

We have been about three weeks at Berlin, and I had some good geological talk with Ferdinand Roemer, Beyrich, Von Kœnen, Gustav Rose, Ewald, Dr. Roth, and Dove the meteorologist, besides Ehrenberg, Magnus, Lepsius, and Du Bois-Reymond, and an animated conversation on Darwinism with the Princess Royal, who is a worthy daughter of her father, in the reading of good books and thinking of what she reads. She was very much *au fait* at the 'Origin' and Huxley's book, the 'Antiquity,' &c. &c., and with the Pfahlbauten Museums which she lately saw in Switzerland. She said after twice reading you she could not see her way

as to the origin of four things; namely the world, species, man, or the black and white races. Did one of the latter come from the other, or both from some common stock? And she asked me what I was doing, and I explained that in recasting the 'Principles' I had to give up the independent creation of each species. She said she fully understood my difficulty, for after your book 'the old opinions had received a shake from which they never would recover.' I shall be very glad to hear what you think of the Duke of Argyll's comments on the 'Origin.' I think that your book is a vast step towards showing the methods which have been followed in creation, which is as much as science can ever reach, and the Duke, I think, has not fully appreciated the advance which has been made, even in his own mind.

I had hoped that a copy of the 'Elements' would have been sent to you while I was still at Berlin. You will find much that is new, and nothing, I think, clashing with the 'Origin.' Please read my description of the Atlantis theory. I fear I shall return and find the book still unborn, which is too bad of the printer. Please let me know how your health has been during the last four weeks.

Ever most truly yours,

CHARLES LYELL.

P.S. In an article in the Berlin 'Punch' on the Pope's encyclical, in which all the innovations which trouble his Holiness are enumerated, 'Die Darwinische Lehre die uns alle Affen macht' was not forgotten.

Dover: January 19.

To SIR JOHN HERSCHEL.

53 Harley Street, London, W.: January 31, 1865.

My dear Sir John Herschel,—I was very glad to see your handwriting, and was on the point of writing to you on two subjects, to which I shall presently allude. The Irish siliceous rhomboids are remarkably regular examples of analogous results which I have seen in various countries where siliceous schists were traversed by divisional planes of cleavage, usually referred to expansion and contraction by heat after the original consolidation of the mass. But as to

the real causes, I have never been able to satisfy myself. Sometimes I have seen very large fragments of shapes similar to that which you send. I will show it at our next meeting to some of those who have made a study of such appearances, and then write to you again.

The first question I wished to ask you, was whether you have read a memoir by Mr. J. Croll on the 'Physical Causes of Change of Climate during Geological Epochs,' in the August number 1864 of the 'Philosophical Magazine.'

It is well worth reading, but I am specially called upon to allude to it because I am now re-editing the 'Principles of Geology,' the ninth edition of which has been out of print for several years, and which my publisher says ought without delay to be reprinted; a more arduous task than he is aware of, since already eleven years have elapsed since the last version saw the light, and Darwin, among others, has done much to shake our old opinions since that time.

In my eighth chapter, I repeated at p. 126 what I had said on your authority in preceding editions, as to the effect of the varying eccentricity of the earth's orbit. In your paper in the 'Geological Transactions,' vol. iii., you stated that the necessary calculations had not yet been made, but Croll now endeavours to found, on Leverrier's data, a difference of one-fifth in the winter temperature when the extreme of eccentricity occurs. If you have not read his paper, I should like to send it to you by post, and should be glad to know how far you think I may rely on his facts and reasons. Of their applicability to geology, I may, perhaps, form an independent opinion. His reasoning as to the direction of currents and the assumption that the physical geography of the globe in the glacial period resembled that now established, is entirely at variance with what we know, as is the assumed periodicity of hotter and colder periods, from the Cambrian to the recent era.

I feel more than ever convinced that changes in the position of land and sea have been the principal cause of past variations in climate, but astronomical causes must of course have had their influence, and the question is, to what extent have they operated? So far as we at present know, the glacial period of the southern hemisphere coincided with

that of the northern, which would not be the case if it were referable to the eccentricity of the orbit referred to by Croll.

As I must allude to his paper, I shall be very glad to have your opinion on its merits. I daresay he sent you an author's copy. The other point on which I am desirous of consulting you relates to the earth-pyramids of Botzen in the Tyrol. More than forty years ago, at Dr. Fitton's I think, you showed me a drawing you had made of those columns. I have never seen anything published on the subject, and meant to visit Botzen, and may, perhaps, be able to go there this summer. But in 1857 I saw some remarkable exhibitions of the same phenomenon in some tributary valleys of the Upper Rhone, on my way to the glacier of Zermatt. I ascertained that the earth-pillars of Stalden in the valley of the Visp, a stream which runs down from Zermatt, belonged to an old glacial moraine, which forms a terrace all along the right bank of the Visp, and consists as usual of unstratified solid mud, with boulders rounded and angular, stuck irregularly in the muddy matrix, and where large blocks occur to form a capping, the rain has washed away some of the loose earth, and left pillars. An earthquake had occurred a few weeks before, which had thrown down chimneys and rent walls, the cracks being still open in the town of Brieg on the left bank of the Rhone, a few miles above its junction with the Visp, and these same shocks had thrown down some of the earth-pillars at Stalden.

I therefore saw, with no small wonder, two isolated earth-pillars, one of which is called the Dwarf's Tower, or in their patois, 'Zwergle-Thurm,' a few miles from Brieg in a valley on the right bank of the Rhone. They are of exactly the same moraine-like structure as those of Stalden, the principal one thirty-six feet high, seven feet diameter, with an angular block at the summit about seven feet diameter, and various other boulders sticking out from the sides.

The slope of the hill-side is very steep, at an angle of about 43°, a deep narrow glen, cut in mica-schist. If the two isolated columns mark the former position of a moraine of an extinct glacier, the entire removal of the rest of the moraine, and the subsequent excavation of several hundred

feet of a narrow glen, are remarkable, and it is strange that an earthquake never threw down these columns; but I suppose they are the last of hundreds that have been shaken down. If the pine-trees were cut down, they would have a most singular appearance.

I could not find any rubbed or glaciated pebbles in the Dwarf's Tower, but I found some in the earth-pillars of Stalden. One block of gneiss, twenty-two feet long and ten high, caps two pillars at Stalden quite in the Stonehenge style. The glaciation of some of the pebbles proves beyond a doubt, in the Stalden case, that the pillars are part of the moraine of one of the old extinct glaciers of gigantic size. I should like to see your drawing, or a copy of it. Have you ever published it? I should like to give a woodcut of it, as contributed by you to my new edition, giving the date, for I suppose in forty years the rain has done something to alter it. I made some drawings of the Stalden and Dwarf Tower pillars which may be of some use as diagrams, but yours gave a much better idea of the appearance, and I have never seen any published engraving, though so much has been written about the old moraines.

With our kind remembrances to Lady Herschel and your daughters, believe me ever most truly yours,

CHARLES LYELL.

To PROFESSOR HEER.

53 Harley Street, London: February 4, 1865.

My dear Heer,—I was very glad to receive your kind letter, and your friendly acknowledgment of the receipt of my 'Elements' makes me feel that I ought long ago to have written to thank you for your 'Urwelt der Schweitz.' At Berlin I began the reading of your 'Urwelt' with great care, and soon found how much the botanical and entomological parts of my 'Elements' had lost by my not having sooner gone to school in the pages of your excellent treatise, the merits of which I discussed with Professors Beyrich and Ferdinand Roemer, both of whom were already familiar with the 'Urwelt,' and fully appreciated its value and originality.

After reading the first hundred pages I was interrupted, but shall recommence very soon.

When I say that the Fontainebleau sand shells are all specifically different from the rich falunian of the neighbouring Touraine, I speak after going into the question with Deshayes, Edward Forbes, Bosquet, and others. Your argument founded on the corals of the Upper Miocene of the West Indies and European Faluns, showing that the ocean of the Miocene period could not have been very deep, or could only have had a moderate depth, is well worthy of consideration. The affinity of the corals seems to me against the existence of a continent, but it does require at least a great many islands like the coral region of the Pacific (or Oceanica).

I long to have your report on the Miocene plants of the Amurland, a country where the living mammalia are now almost all of the same species as those living in Western Europe.

When I have read more of your book I will send you more comments, and hope you will do the same in regard to mine. Your criticisms are the more valuable because I am now re-editing the 'Principles of Geology,' and am therefore going over much of the same ground, and have often no opportunity of putting myself right.

We are quite well, and my wife joins me in kind regards to you and your family. The sudden death of Dr. Falconer has shocked us much. He is a great loss to science, and much knowledge dies with him.

Believe me ever most truly yours,

CHARLES LYELL.

To SIR JOHN HERSCHEL.

53 Harley Street, London, W.: February 21, 1865.

My dear Sir John,—The drawings[3] are most valuable, and it is tantalising not to be able to use all of them, or to have only to extract telling bits of them. The Stalden case is particularly good, because a portion of the moraine not yet divided into columns has two big stones lying at the top. But the beauty of the groups of the Botzen columns

[3] Of the Botzen earth-columns.

is far greater. They are most elegant, and I cannot believe that the large undivided masses which you allude to, in the lithographed sketch of which unfortunately the date is not given, can be taken from the same point of view; at least, that would imply a more rapid rate of waste than I suspect takes place.

I hope to get to Botzen this year, and shall take your drawing and try to find your point of view, so as to judge of the amount of change in forty-four years; if it is not very considerable, then the splitting up of the unbroken masses to which you allude cannot have taken place between the execution of the print and your visit. The Stalden one is of more interest to me at present, because I ascertained it to be the work of one of the old extinct glaciers, containing glaciated fragments of rock, so that ever since the era of extreme cold there has been no flood in this valley to interfere with the gradual formation of these columns by pluvial action. On this account it is valuable, because the columns go down so low, the base of some of them being only slightly above the river, which would not have been the case if a flood had ever cleared away the lower part of the moraine.

As you have been looking into my new edition, I should like you to read Chapter XV., which is new, as it will give you some idea of the new part which fossil botany is playing, and the arguments for a Miocene Atlantis will, I think, interest you. I see that Professor Phillips has been reading a paper to the Royal Society on the appearance of the planet Mars at different seasons, and the quantity of snow in different years. Would it be possible to say whether at present there is a preponderance of land in polar as compared to equatorial latitudes in that planet? Phillips has always ignored my cause—the varying distribution of land and sea as influential in accounting for former changes of climate, though he has never, I think, given any good reasons for slighting it. If in Mars, as well as in the earth, land and sea are always shifting places, it may sometimes happen that the position of land and sea in the planet nearest the sun may be so favourable to cold as to counterbalance the effects of greater proximity to the great source of heat.

Ever most truly yours,

CHARLES LYELL.

To THOMAS S. SPEDDING, ESQ.[4]

53 Harley Street: March 12, 1865.

My dear Spedding,—It is always a great pleasure for me to hear from you, and so rare for me to differ from you in opinion that, had I not been four times across the Atlantic, and seen both North and South of the United States, I should doubt my own faith when I found you questioned its soundness.

I must begin by stating that I entirely differ on the first point you lay down, namely, the right of Secession. I think it was about fourteen years from the first outbreak of the war with Great Britain, that the thirteen States tried to get on with such a constitution as might have justified any one of the independent States in seceding. But they found it would not do, and they then made a constitution which is as much violated by Secession as would our constitution be if Ireland, Scotland, Wales, or even Yorkshire should declare themselves independent because they were dissatisfied with a new Parliament, and complained that they were not fairly represented.

Pray understand me, that I admit that every people have the right of rebellion or revolution whenever they are oppressed, or suffer such grievances as renders such an extreme measure natural.

But you have only to read Vice-President Stephens' earnest address to the legislature of his own State (Georgia) *before* the outbreak, when he tried to point out to them the folly of the proposed separation, to see that so far from having any just ground of rebellion, the South had been dominant to the last in foreign and domestic politics, had always had the lion's share in the choice of Presidents and other civil appointments, and in officering the army and navy. In short they rebelled simply because Lincoln's election showed them that the Free-Soil or Republican party were at last determined to resist the extension of slavery into new territories, although they would still permit them to retain the institution at home, because they were pledged to do so by the constitution. The Morrill Tariff was never

[4] Of Mire House, Cumberland.

put forth by the Southerners as a ground of complaint, although it was afterwards by Spence, who, as he was a paid advocate of the South, ought not to be compared to Goldwin Smith.

The South had become very aggressive in regard to slavery when the North, who had too long yielded to them, determined to resist. No doubt the South were right in foreseeing that the non-extension of slavery into new regions would in the long run be tantamount to its extinction, or, at any rate, to their rapidly diminishing importance in the political scale. But this did not justify the rebellion.

I differ from you as to our having ever had any proof of the unanimity of the South in favour of Secession. No one of the Southern States took the steps, which by their constitutions they were bound to take, in order to obtain a sanction for an organic change in their constitution, even for one of much less moment than Secession from the Union. I believe that the slave-owning oligarchy did not dare call a Convention and put the question to a popular vote. I doubt whether they would have carried it even in South Carolina, and feel sure that they would have been beaten in Georgia and Tennessee by large majorities; the Negroes going for nothing, and the white population alone voting. Sherman's unopposed march through Georgia and South Carolina does not surprise me. You will grant that if the population in those parts of our island where the artisan and working class are most intelligent, and the Baptists and some other sectarians very numerous, had been polled, whether in the first or fourth year of the war, they would have given a majority of votes for the North; and yet if our aristocracy had chosen to drag us into a war in favour of the South, they might have raised regiments out of the very class which felt most strongly for the North and against the slave-owners, and they would have fought with spirit when once excited, and fairly embarked in the feud. I have my fears as to the result in this country of a wide extension of the suffrage; but if the opinions of such a class as the artisans of Lancashire, Birmingham, Newcastle, &c., were better represented in Parliament, the Government would have been more vigilant in preserving neutrality, and fewer 'Alabamas'

would have been built and allowed to steal out, and we should be in less danger now of a war, or at least of having to support additional taxes in order to be prepared for the worst after four years of insolent and malignant writing by such papers as the 'Times' and 'Saturday Review,' which has estranged from us and embittered that party in the United States which had the greatest feeling for England, while it has done nothing to soften the hatred which millions of Irish birth, with the democratic party which side with them, cherish against us.

There has been a great combination of motives which have led the aristocracy to take part against the North. The most influential, I think, has been a John Bullish desire to see the dismemberment of a power which if it does not divide will soon interfere with British supremacy. Next in order comes a sincere wish, for the good of mankind as they think, for the failure of democracy. Thirdly, I think the Liverpool merchants, shipbuilders, and others were anxious for the destruction of the shipping of their rivals. Fourthly, the general ignorance (in great part wilful), of the ruling classes, of the real state of things in America, cannot be exaggerated, and if such men as Gladstone and Earl Russell had been only six weeks in the United States, they would never have said what they did. If you had lived among the Americans you would not have wondered at the loyalty they have shown for the Union, which outside of the New England States has had more to do with the spirit they have shown than the feeling against slavery. The two motives taken together—the integrity of the empire, and the non-extension, and for the last two years the extinction of slavery—constitute to my mind better grounds for a protracted struggle than those for which any war in our time, perhaps in all history, has been waged. Although I think the Irish might have rather a better case than the Southerners for repeal, yet I would fight for any number of years rather than let that island be independent of us; and there is no Englishman who, if he had settled in one of the North-Western States of the Union, would not have the same feeling in regard to allowing the States at the mouth of the Mississippi to belong to some other power. How could the

loss of Bengal be compared to this, and yet how many thousands of lives and millions of pounds should we not have expended, rather than have allowed even India to secede? If you visited America you would soon see that the vast majority have such a feeling of security of property, equality of rights and of religious sects, as makes them feel toward the Government as the rich and upper classes do towards our own.

Lincoln and his colleagues are not the sort of men that you and I would put into a Cabinet, so far as their conventional manners are concerned, but you must recollect that this is not the feeling of ninety-nine in a hundred of the electors on the other side of the Atlantic. But after all, are Lords Palmerston, Clarendon, and some others, men of higher principle than Lincoln, or as high? I am intimate with men equal to any here in literary attainments and in polish of manners, and of independent fortune, in the United States, whom I used to wish to see in power instead of the coarser class into whose hands the reins of Government have been placed. But these men and the majority of capitalists would, I am sure, have knocked under to the South, and the slave-owner would have made a compromise by which his institution would have been more rampant than ever. If slavery, which was more injurious to the white man than to the Negro, and which to a certain extent poisoned the political institutions of the North, as well as keeping the South in ignorance, is got rid of, it will be owing to a very extended suffrage among a class which had had much instruction, for working men, but to whom the aristocracy of wealth and refinement were not prepared to make great sacrifices for such an object. Nevertheless, when they were once embarked in the contest a very large proportion of young men of the highest attainments and fortune went to the war, many of them serving in the ranks, and this year after year, when the enormous sacrifices and danger which they incurred were thoroughly realised.

The 'Times,' whose leaders against the United States were always copied into their newspapers, did much in one way to help the North. It made them feel that if they fell

to pieces (and the Secession of the South once yielded would have been followed by other dismemberments), they would be treated by foreign nations, at least by us, with that contempt to which the weak alone are exposed. The writers of the money articles of the 'Times' hoped to damage them financially, and they must have succeeded so far as to cause the English to sell out, instead of taking any of the new loans, about one-tenth of which has, I am told, been purchased by the Germans and other continentals. But the result has only shown how ignorant the 'Times' was of the wealth of the Union, as they have already borrowed some 300 million from themselves, and a fourth hundred million is now forthcoming, almost all from the same source. It is surprising that year after year the prophecies of the 'Times' correspondent as to the impending bankruptcy of the North, the impossibility of their obtaining any more men, and their disunion had been falsified, while the opposite statements of the correspondent of the 'Daily News' on the same subject were as regularly verified by the events, including the Presidential election, that the 'Times' should have tolerated the continuance in office of writers who must have associated with Confederate agents at New York. You do not seem to think that people in good society here have been 'Times'-ridden, but I assure you I could always tell what people would think on each separate question and event throughout the war, if, before going to a party, I glanced at the leading journal; and if, as often happened, incidents of great importance were under discussion, such as the treatment of prisoners by the Southerners, as proved before a commission, or the fact that only eleven per cent. of foreigners entered into the army, as officially shown, few regular readers of the 'Times,' when told of the suppression of such documents, cared to know the truth, because it was disagreeable to have a chord struck out of harmony with the antipathies which had been excited by their daily reading. They would sometimes tell you that life was not long enough to read more than one paper. The contrast in the feelings of the Germans, when last Christmas we mixed with the reactionary Tory party, as well as with the Liberals at Berlin, with the sentiment in good society here, was most striking, and Judd, the American Minister there, remarked

to me how enviable was his position as compared to that of Mr. Adams in England. But had people read the 'Daily News,' 'Weekly Times,' and 'Star,' in this country, as well as the 'Times,' a state of feeling among the literary and scientific men more like that which I found in Prussia would have prevailed.

By the way, the ability, literary and political, with which the leaders of the 'Weekly Times' have been written for the last four or five months, during which I have taken it, on European as well as American affairs, has struck me as marvellous for a penny paper.

You cannot say too much of the spirit, courage, and military skill which the Southerners have displayed. They have certainly shown the power of an aristocracy to command and direct the energies of the millions, and as by far the largest true Anglo-Saxon army that was ever organised in history, we may feel proud of their prowess, for there was not that large mixture of Celtic and German blood which was on the Northern side. I also respect men like Lee, who, after Secession was determined on, and after long and painful hesitation, decided that Virginia with its State sovereignty, and not the Federal Union, was his country. This doctrine had been carefully inculcated into the minds of the Southerners, a minority only of whom consisted of the mean whites, while the majority, such as formed the bulk of the soldiers of Stonewall Jackson, were good honest farmers, largely drawn from the upland country, having few, and sometimes no slaves, but very ignorant compared to the Northerners of the same class, even unable to read and write, because the planters wished them to be so, and they could seldom get a school within forty miles' distance, and then it was too expensive a one and meant only for the planters' children. Although a notion prevails here that refinement was the comparative privilege of the Southerners, they exhibited in truth a low form of civilisation. They have produced no historians, poets, great preachers, novelists, nor any literary men; orators and politicians alone, for to those departments their aristocracy devoted themselves. The rebellion was chiefly brought about by a small number of ambitious men, many of whom while holding office under the Federal Constitution

treacherously prepared for Secession by filling the Southern forts with cannon and ammunition, sending away ships of war to distant ports, &c. &c. These men, for whom so much sympathy has been shown, formed a party which has always given the most trouble to England, and if they are subjugated, it will be far more easy for the Northerners, who are industrious, and who have a distaste for military service, to keep the peace, provided we can stave off an outbreak for a few years. They will be bound over by heavy recognisances to keep the peace, for at first the interest of their debt at 6 or 7 per cent. will be about equal to our own, and a terrible burden. But I am very hopeful, for there will be a great tide of free labour pouring into the South, where slave labour has hitherto had a monopoly. The resources of a magnificent territory will be for the first time developed, and having, since I first visited America, witnessed what has been done in Texas and California, which did not belong to the Union when we first went there in 1841, I feel sure that people here will be astonished at the rapidity with which the wounds will be healed when once the contest is over.

My late friend M'Ilvaine, once secretary of the United States Bank, before the days of repudiation, used to assure me that the ignorance of the Washington Legislature of political economy, and their want of sound free-trade notions, was extreme. They are showing this now, and have aggravated their debt by not being able to check the over issue of paper by the State banks, to say nothing of enormous corruption of contractors and others. If one did not recollect our history in the war with France, and the Protectionists of thirty years ago, one might despair. But some adversity was wanting to improve and chasten the republic, and they will have it now.

It is strange that Canada is so anti-free-trade, and makes me grudge expenditure in their defence. Australia, I fear, is equally desirous of 'protecting native industry.' But we must have patience. I expect the military discipline to teach even civilians in the United States habits of subordination to central authority, which they needed, and that the large debt will strengthen the Federal power which formerly

could not control the States from buccaneering and other enterprises.

Had the States been dismembered, there would have been endless wars, more activity than ever in breeding slaves in America, and a renewal of the African slave trade, and the future course of civilisation retarded on that continent in a degree which would not, in my judgment, be counterbalanced by any adequate advantage which Europe would gain by the United States becoming relatively less strong.

You must recollect that from the first I had a deep conviction that the North would be staunch for the Union, and for non-extension of slavery, and that they must prevail, having such vast odds, not only of wealth and numbers, but of knowledge and intelligence on their side.

I believe that if a small number of our statesmen had seen what I had seen of America, they would not have allowed their wishes for dismemberment to have biassed their judgment of the issue so much. Certainly I never reckoned on the South being able to make so splendid a stand, which will be memorable in history; but then you must recollect that I took for granted that Lincoln would never attempt general emancipation. When abolition was exchanged for non-extension, we could not reasonably have expected that to be carried without four or five years of war, or what was equivalent to a conquest of the South. The result, I think, will be worth all this dreadful loss of blood and treasure. As to the internal happiness of the States, so long as they are not divided by hostile tariffs, and are not forced like the Europeans to keep up ruinous standing armies during peace, I am sure that had you travelled in the United States you would feel, as I do, that their political organisation, with all its faults, does not prevent their rapid and successful development. Whatever it may be for the rich, who have shown, however, their loyalty to the constitution in this war, I certainly think that for the millions it is the happiest country in the world.

As for their external policy, it has hitherto been mainly guided, not by a democracy, but by a slave-oligarchy. But when that is got under, there is another curse, which like slavery they owe to this country, and that is the millions of

Irish, who though their condition is wonderfully improved by the schools and good wages which they obtain there, form a class to whom the suffrage ought never to have been extended.

As to the foreign policy of the United States, could it be more selfish and aggrandising than that of Bismarck, or of France when they appropriate Savoy to themselves; and have we much to boast of? Italy was not helped by us to make the step she has made. But all this you will grant, and you will say that it only shows the danger of too much power wielded by any one country. But as I always felt sure of the success of the North, I have been vexed at what I consider the folly of this country doing so much to irritate the better class of Americans. We have, at the cost of several millions a year of taxes for the rest of our lives, indulged in four years of vituperation of a people who were doing exactly what we should have done, and it will be unnecessary now for the Americans to make war with us; they have simply to bide their time, and whenever we get into a quarrel with any power, they have only as neutrals to imitate us, and the whole of our commerce will be swept off the seas. I hold that it is by the ignorance even more than to the prejudices of our ruling class, that this state of things has been brought about, and it has been partly owing to the monopoly of influence by one single journal, which I think tells far more in an affair of this kind than the Cabinet or even the Legislature.

Believe me, my dear Spedding, ever most truly yours,

CHARLES LYELL.

P.S. That there were never more than eleven per cent. of foreigners in the Federal army, I have from the American Minister, Mr. Adams. But this does not of course include born citizens of the United States of Irish and German parents. It only disproves the absurd charge of the Federals having fought with a hireling force, which people in *good* society still believe here.

To Professor Heer.

53 Harley Street: March 16, 1865.

My dear Heer,—I have been frequently citing your very instructive 'Urwelt der Schweitz,' in the new edition of my 'Principles of Geology,' and I am now referring to what you say of the huge blocks found at many points in the Flysch. This 'Flysch,' which I studied at Vienna, Salzburg, Genoa, and elsewhere, has always perplexed me much. You say truly that to suppose glaciers when the climate as indicated by the organic remains was so hot, would be a violent hypothesis. The absence of organic remains, and suspension of life in the seas during a glacial episode, might be conceived, and I should be inclined to imagine this, if I could rely on the facts which you give as to the large blocks of lias, oolite, granite, gneiss, talcose rock, &c., observed in the conglomerates of the Flysch.

I should be very glad if you could assure me that there is no doubt of large-sized angular blocks having been seen fairly embedded in the Flysch. I am well disposed to believe it after having seen them in the Italian Miocene.

You will be glad to hear that our friend Dr. Joseph Hooker has succeeded to his father at Kew, and is now fairly installed as the head of that department, which is becoming every day more and more creditable to this country as a scientific institution.

A good dissecting-room and a regular paid anatomist has been added to the Zoological Gardens, which will now become a good school of comparative anatomy, as so many rare animals die there. I am very busy at present, trying to make up my mind how much former changes in the eccentricity of the earth's orbit may have exaggerated the winter's cold, and helped to cause a glacial period.

Did I tell you, when I last wrote, that Agassiz has found *roches moutonnées* in the Organ Mountains near Rio Janeiro? If there were glaciers in that latitude, how did the existing tropical plants survive the chill of the glacial period? It seems improbable, according to Darwinian or any other principle, that the peculiar and distinct tropical vegetations of Australia, South America, and Africa should be all of post-

glacial origin. There has not been time for such an amount of development of creational power, unless we admit the doctrines of the paroxysmalists.

Believe me, my dear Heer, ever most truly yours,

CHARLES LYELL.

To MR. PENGELLY.

Munich: July 26, 1865.

My dear Mr. Pengelly,—I hear from Mr. John Moore, that you have written an important paper about the Trade-winds, Gulf-stream, Sahara, &c. As you may not have had separate copies to give me one, I shall depend on your telling me in what Journal I can buy it, for it is a subject which I am working at. Is it not singular that the hot water of the Tropical Indian Ocean should, as we are told, flow round the Cape of Good Hope, across the Atlantic to Brazil, while the water of the Gulf of Mexico flows NW. towards the polar regions? If the Equatorial Sea, north of the line, sends its hot water towards the Arctic regions, the Equatorial Sea, south of the line, ought to send its warm waters towards the Antarctic latitudes. I suppose it is the geographical conformation of the land, and bottom of the sea, that causes this different behaviour of the southern and northern currents. If you have been studying the trade-winds, you can perhaps enlighten me. I presume that if there were no such winds, the heated tropical waters expanding and becoming lighter, would flow towards the north and towards the south from the equator, while cold under-currents would be flowing in opposite directions.

Believe me ever truly yours,

CHARLES LYELL.

To SIR CHARLES BUNBURY.

Dover: August 31, 1865.

My dear Bunbury,—I had expected to write to you from Calais, but we found it answer best to come over and sleep here. We have had rather a rough passage, but are all pretty well recovered, and waiting for our luggage from the Custom House. The Kissingen waters have done me as yet

neither harm nor good. Our Alpine tour answered very well. The weather upon the whole favourable, and I accomplished the only two geological points I was bent on clearing up. First the pyramids of Botzen, and the similar earth-pillars of several places in the Vallais, or rather in the ravines of small tributaries to the Upper Rhone; and secondly, to see the Glacier Lake of Aletsch, and whether it would throw any light on the parallel roads of Glen Roy, which it does most decidedly; a large terrace being formed exactly on a level with the Col which separates the valley of the said Aletsch Lake from another valley, that of the Viesch Glacier. Some persons have shrunk from the idea that the drainage of the old Glen Roy lakes was effected in a direction opposite to that by which the valleys are drained where the parallel roads occur. This is just what actually happens when the Aletsch Lake, or Märjelen See, as they call it, is blocked up by a barrier of ice, and gets quite full. It then flows over a Col, or rather the stream issuing from it passes over the Col on a level with the terrace bounding the lake. I luckily saw the lake forty feet lower than usual, and was able to examine the structure of the great shelf which is level with the Col.

As to the earth-pillars, I had made up my mind before, that those of Stalden, near Zermatt, were remnants of a moraine of one of the great extinct glaciers, and I can prove that every other case agrees as to origin in glacial time. Some of the columns are from sixty to eighty feet in height.

Such a thickness of coherent unstratified mud, with the requisite accompaniment of erratic or capping stones, could scarcely be found in any but a glacial formation.

Leonard has been a most agreeable companion. He has got on in German as well as in geology.

We shall start for the Birmingham Meeting on Tuesday next, and return to town on Saturday, where I shall much enjoy being stationary after so much wandering.

Ever affectionately yours,

CHARLES LYELL.

To Sir John Herschel.

53 Harley Street: November 28, 1865.

My dear Sir John Herschel,—I have often been on the point of writing to tell you the result of my comparison on the spot of your excellent drawings of the Stalden and Ritten earth-pillars and pyramids, with the scenes which they now present after nearly half a century. I shall now dictate a few words on the subject to my amanuensis, having found it necessary this last year to abstain as much as I can from using my own eyes, whether in reading or writing, by which means I get on well, and seem to have acquired a new lease for my eyes, and for ordinary purposes they feel much as they used to do.

I took my eldest nephew, aged fifteen, with me on my last expedition to Switzerland and the Tyrol, which added much to our pleasure, for he is quite an enthusiast in geology, conchology, chemistry, and mineralogy.

Except occasional attacks of lumbago, I am battling well with sixty-eight years, but am obliged to be very careful of myself. Remember us kindly to Lady Herschel and your daughters.

Believe me, dear Sir John, ever most truly yours,

Charles Lyell.

I found the Stalden columns when I first saw them in 1858 had suffered greatly from the earthquake of 1855, which had rent the walls of houses in the town of Visp, some of them not repaired when I was there. The principal capping stone had been thrown down, and many others probably loosened, for great havoc had been made in the seven years between 1858 and 1865. I suspect that but for this shock I should have found as many pillars as you saw.

I convinced myself that the unstratified mass in the valley of the Visp, and another on a still grander scale in the valley of the Borgne, which leads to Evolena near Sion, in the Vallais, are the moraines of old extinct glaciers. It is not merely the absence of stratification and of all organic remains, but decidedly glaciated stones, pebbles, and erratics which bear out this opinion. The same holds true with the

Botzen red mud, where I found all the same proofs of a morainic origin.

I could get no good photograph of these last, and no engravings in the least degree comparable to your drawings. I am therefore very desirous of availing myself of your permission to use your drawing of the Ritten pillars, perhaps as a frontispiece to my new edition. I took much pains to try and ascertain the exact point of view from which you took your sketch. I often thought I had discovered it, and it was not till the last day that it occurred to me that you must have been looking up the ravine, whereas I had made up my mind you were looking down, in consequence of the view which I got from the bridge the first day answering so nearly to your representation, making allowance for such slight differences in the columns as forty years might well bring about. Have you sufficient recollection of the place to be able to tell me, first, whether you are looking up the stream; secondly, whether on ascending the valley one would pass between *a* and *b*; thirdly, is not the torrent entirely hidden from sight by the wood? I conceive that it would go to the bottom between the principal groups of pillars in the line from *a* to *c*, then from *c* to *d*, and then in the line *d*, *e*, *f*; but of this last I am not sure, for there hardly seems space between the foreground on which the tree *e* stands and the opposite rock *g*. As I presume that the size of the copy you sent me agrees with that of your original drawing, the tracing which I enclose will suffice to show you what I mean, as my letters would in that case be exactly opposite the points in your original to which I allude.

I suspect that the scene has not altered materially, not even in any of its details, since you were there.

CHAPTER XXXVIII.

JANUARY 1866–APRIL 1868.

ON GEOLOGICAL CHANGES OF CLIMATE—TICKNOR'S 'SPANISH LITERATURE'—THE INQUISITION BEARING ON NATURAL SELECTION—DUKE OF ARGYLL'S 'REIGN OF LAW'—MR. DARWIN ON 'VARIATION OF ANIMALS AND PLANTS UNDER DOMESTICATION'—REMINISCENCES OF FARADAY.

[This year, 1866, he made excursions to the coast of Suffolk, to Weymouth, and later on to Forfarshire, returning south by Whitby. He received the Wollaston Medal at the Geological Society for eminence in his science.

In 1867 the Exhibition was held in Paris, and after going there, he went later on to Scotland, and attended the British Association at Dundee. The tenth edition of his 'Principles of Geology,' much enlarged, was brought out this year in two volumes.

In the year 1868 he made expeditions in various parts of England, and was at the Norwich British Association, and afterwards Sir Charles and Lady Lyell spent September at Tenby and its neighbourhood with his brother's family.]

CORRESPONDENCE.

To Professor Heer.

53 Harley Street, London: January 21, 1866.

My dear Heer,—I am much obliged to you for your letter to me announcing the death of our friend Gaudin, for whom I had a sincere regard, and who was one to whom I always felt drawn so much, that had I seen as much of him as you did, his departure would have made an irreparable void in the circle of my friends. He was indeed a most loveable person, and he would have occupied a very leading place in science if he had had more leisure to devote to it, and had his health and physical strength been more on a par with his talents.

I should have written sooner to thank you for your valuable pamphlets, but I have been very much absorbed with a new theory of changes of climate dependent on variations in the eccentricity of the earth's orbit. I am called upon to give an opinion as to the influence of this cause in a new edition which I am preparing of the 'Principles of Geology.'

I by no means abandon my old doctrine, that the principal cause of former fluctuations in temperature, and of warm and glacial periods, has been the ever-varying position of the sea and land; but it is now ascertained that the extreme distance by which the earth sometimes deviates from a circular orbit is such as to carry it away 11,000,000 of miles from the sun in aphelion, instead of 3,000,000 as at present, and Mr. Croll of Glasgow has pointed out that the cold of winter in aphelion would be very intense during such maximum eccentricity.

I ought to have said that this 11,000,000 of miles occurred 230,000 years ago, and was not the extreme possible maximum, which I believe would be 14,000,000 of miles. The proximity of the earth to the sun in perihelion would be proportionally great; but Mr. Croll maintains, and with some reason, that most of this excessive heat would be expended in melting part of the accumulated ice of winter, and this process would cause so much fog and cloud as to prevent the intensity of summer heat from overcoming all the effects of winter's cold. When I have worked more upon the tables which the Astronomer Royal is having calculated for me, I will let you know more about it.

I received very lately your beautifully illustrated paper on the 'Pflanzen der Pfahlbauten.' Your opening address of last year to the Zürich Natural History Society interested me greatly. Among other things your remarks on the flora of the interglacial period. I am very glad to hear of your forthcoming work on the 'Plants of the Chalk,' and I hope you will be able to devote a portion of it to the fossils collected by Dr. Debey at Aix-la-Chapelle, for I begin to despair that we shall ever have any account of them unless you undertake the task.

My friend Professor Huxley is preparing a paper on

the five new genera of reptiles discovered in the ancient coal of the county of Kilkenny, in Ireland; there are eight or nine species, all of these new, some of them four or five feet long, of various forms, one of them with small fore feet like a siren, and abortive hind feet, having the shape of an eel.

All the genera are of the labyrinthodont family, and therefore, though they have well-ossified vertebral columns, their low place in the scale accords well enough with the theory of progressive development. At the same time, when you recollect that ten or twelve years ago no single reptile was known from a rock so ancient as the coal in any part of the globe, one cannot reflect on the rapidly increasing number of these carboniferous amphibia without being prepared for the discovery of some more highly organised vertebrata of the like antiquity.

Believe me, my dear Heer, ever very faithfully yours,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

53 Harley Street: March 10, 1866.

My dear Darwin,—Your precious MS. has arrived safe. I will return it registered in a few days. I am much obliged to you for the privilege of reading it; and in regard to the notes prepared for the new edition, I am amused to find how many of the topics are the same as those treated of in the letters of yourself, Hooker, and Bunbury, in commenting on the observations by Agassiz of marks of glaciation in the Organ Mountains. By the way, you allude to Hooker's discovery of moraines in the Sikhim Mountains, which I believe are only about 7° farther from the equator than the Organ Mountains. It is very interesting to read Hooker's letter dated 1856, and to see the impression which the MS. made on him, causing him to feel, as he says, 'shaky as to species' so long before the 'Origin' was published. We certainly ran no small risk of that work never seeing the light, until Wallace and others would have anticipated it in some measure. But it was only by the whole body of doctrine being brought together, systematised, and launched at

once upon the public, that so great an effect could have been wrought in the public mind.

I have been doing my best to do justice to the astronomical causes of former changes of climate, as I think you will see in my new edition, but I am more than ever convinced that the geographical changes are, as I always maintained, the principal and not the subsidiary ones. If you snub them, it will be peculiarly ungrateful in you, if you want to have so much general refrigeration at a former period. In my winter of the great year, I gave you in 1830 cold enough to annihilate every living being. The ice now prevailing at both poles is owing to an abnormal excess of land, as I shall show by calculation. Variations in eccentricity have no doubt intensified the cold when certain geographical combinations favoured them, but only in exceptional cases, such as ought to have occurred very rarely, as paleontology proves to have been the case.

Ever most truly yours,

CHARLES LYELL.

To SIR CHARLES BUNBURY.

53 Harley Street: September 3, 1866.

My dear Bunbury,—I have been so absorbed in my proofs and new climate chapters, that I have been writing to no one, but must tell you a piece of botanical news which has interested me much. In recasting my chapter on 'Progressive Development,' I have stated that there was no unquestionable case of an Angiosperm so old as the carboniferous period. Mr. Carruthers of the British Museum, on reading my proof, told me that he had just seen in Edinburgh a specimen from the coal-shale of Granton, which is an undoubted Monocotyledon, and which has been figured some years ago in the 'Transactions of the Edinburgh Botanical Society,' under the name of *Pothocites Grantonii*, Dr. Paterson having named it with the approbation of Greville and other authorities of Auld Reekie. Mr. Kippist, Librarian of the Linnæan Society, showed me coloured plates of various species of Pothos, and of allied genera of the Aroideæ, to prove that sometimes the spathe is some way

from the bottom of the flower, and therefore that the broken-off part may, as Paterson supposes, represent the spathe. After this I shall not despair of your Antholite being angiospermous. But how rare are such specimens! about one in a million. Agassiz has written an interesting paper on the 'Geology of the Amazons,' but I regret to say he has gone wild about glaciers, and has actually announced his opinion that the whole of the great valley, down to its mouth in lat. 0, was filled by ice, and dammed up by a moraine since destroyed by the sea, by which means he accounts for freshwater deposits such as we find in the valleys of the Mississippi and Rhine. He does not pretend to have met with a single glaciated pebble or polished and striated rock *in situ*, and only two or three far-transported blocks, and those not glaciated. As to the annihilation during the cold of all tropical and extra-tropical plants and animals, that would give no trouble to one who can create without scruple not only any number of species at once, but all the separate individuals of a species capable of being supported at one time in their allotted geographical province.

Ever affectionately yours,

CHARLES LYELL.

To DR. JOSEPH HOOKER.

73 Harley Street: October 20, 1866.

My dear Hooker,—I am sure there is some screw loose in all the climate theories now afloat. When I send you my thirteenth, or astronomical chapter, you will better understand one of the principal difficulties, arising, I think, from the estimates made by Herschel and Poisson of the heat received by the earth from the sun, as distinct from the assumed heat of space. If they are right, the difference between the sun's heat in the northern hemisphere and in the southern ought to be very great, even with the present eccentricity, and five times greater, as Croll says, with a maximum eccentricity, and the winter's cold ought to be in proportion. But if it were so, the monkeys would never have lived through the cold of the last period of maximum

eccentricity at the tropics. But I suspect that the vapour to which you allude, and on which Tyndall has written so much, may equalise the heat and cold caused by greater proximity to, and distance from, the sun.

I hope you will have patience to read my thirteenth chapter, as I know you will tell me frankly what you think of it. It has cost me a great deal of time, for I had to go to school in astronomy, and moreover many of the things it was necessary to learn were not to be found in the ordinary elementary books, and I had to write to Airy and Herschel.

Without John Moore's assistance, I should never have got on.

With many thanks,

Ever affectionately yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

73 Harley Street, London: February 8, 1867.

My dear Ticknor,—I have been looking through your 'Spanish Literature' in search of some remarks which I had fancied you had made on the effects of the Inquisition in sacrificing the lives of so many men of superior mental power, and the moral and intellectual deterioration of the Spanish population which it produced.

But although I have found passages relating to the mischief done by the systematic persecution persevered in for centuries, it strikes me that I have missed the place I was in quest of. Possibly it was in some one of Prescott's works. At any rate I will tell you in what manner I was desirous of applying the exterminating action of the Inquisition to the subject I have now in hand.

You have read Darwin on the 'Origin of Species,' and know what he means by natural selection. If it were possible so to frame the institutions of a country, that the population should be chiefly kept up by breeding from those individuals, male and female, which are the best morally and intellectually; this selection would tend, according to Darwinian principles, to improve the race, and if an opposite

system were persevered in an opposite result might be expected. Perhaps the best experiment hitherto made is that which we owe to the Inquisitors, and the result in regard to the deterioration of the race is perhaps as satisfactory as Darwin could desire. Yet even in Spain there have been so many disturbing causes that the experiment has been very incomplete. Many aspiring and powerful intellects naturally went into the Church, and is it not true that their vows of celibacy were sufficiently set at naught to allow the children of such ecclesiastics to constitute no insignificant part of the population? Can you give me any facts as to children of eminent ecclesiastics who were acknowledged by their parents as such? Have you any idea of the numbers who perished by the hands of the Inquisitors, and for how many centuries this went on, and what may have been in round numbers the population of Spain at the period of the most severe persecution? Of course a large number of those who were sacrificed would not have great claims to superiority, but it would be enough for my purpose if as a whole they constituted that portion of the people who were superior as independent thinkers and inquirers, and had more moral courage and character than the ordinary herd.

The argument would turn in a great degree on statistics, and some of the data are not obtainable, especially the extent to which each generation was recruited from the clergy. It may be said that although the Spaniards are doing so little now in literature, and nothing in science, and producing no great statesmen or men of commanding genius, yet we cannot be sure that the race has suffered serious degradation, or that if like Italy they could be set free, they might not be found as capable as ever of yielding a crop of great men. But Italy has been kept down by foreign domination, whereas Spain has had fair play, and very little meddling from without. It seems to me therefore that selection has really done its work, and that a race has been produced as incapable of keeping pace with the progress of the age, or boldly originating new ideas or questioning the truth of old ones, as orthodoxy could desire.

Ever affectionately yours,

CHARLES LYELL.

Extract of Letter to A. Wallace, Esq.

May 2, 1867.

I forgot to ask you last night about an ornithological point which I have been discussing with the Duke of Argyll. In Chapter V. of his 'Reign of Law' he treats of humming-birds, saying that Gould has made out about four hundred species, every one of them very distinct from the other, and only one instance, in Ecuador, of a species which varies in its tail-feathers in such a way as to make it doubtful whether it ought to rank as a species—an opinion to which Gould inclines—or only as a variety or incipient species, as the Duke thinks. For the Duke is willing to go so far towards the transmutation theory as to allow that different humming-birds may have had a common ancestral stock, provided it be admitted that a new and marked variety appears at once with the full distinctness of sex so remarkable in that genus. According to his notion the new male variety and the female must both appear at once, and this new race or species must be regarded as an 'extraordinary birth.' My reason for troubling you is merely to learn, since you have studied the birds of South America, and I hope collected some humming-birds, whether Gould is right in saying that there are so many hundred very distinct species without instances of marked varieties and transitional forms. If this be the case, would it not present us with an exception to the rule laid down by Darwin and Hooker, that when a genus is largely represented in a continuous tract of land, the species of that genus tend to vary? In regard to shells I have always found that dealers have a positive prejudice against intermediate forms, and one of the most philosophical of them—now no more—once confessed to me, that it was very much against his trade interest to give any honest opinion that certain varieties were not real species, or that certain forms, made distinct genera by some conchologists, ought not so to rank. Nine-tenths of his customers, if told that it was not a good genus or good species, would say what they wanted was names, not things. Of course there are genera in which the species are much better defined than in others, but you would explain this, as Darwin and Hooker do, by the greater

length of time during which they have existed, or the greater activity of changes, organic or inorganic, which have taken place in the region inhabited by the generic or family type in question. The manufactory of new species has ceased or nearly so, and in that case I suppose a variety is more likely to be one of the transitional links which has not yet been extinguished than the first step towards a new permanent race or allied species. Sclater gave me *Euplocamus melanotis* and *E. lineatus* as an example of two distinct species—Tenasserim and Pegu—which pass through every intermediate variety in the intervening country of Arracan; but when I asked if it was proved that the two extremes of the series would not intercross and produce fertile hybrids, he said the experiment had not been fairly tried. I suppose we have a good deal to do before we get all the facts which we shall one day probably have in confirmation of the theory of transmutation, or of such a divergence as will be accompanied by the sterility of hybrids. It may require several hundred thousand years. M'Andrew told me last night that the littoral shells of the Azores being European, or rather African, is in favour of a former continental extension; but I suspect that the floating of sea-weed containing their eggs may dispense with the hypothesis of the submersion of 1,200 miles of land once intervening. I want naturalists carefully to examine floating sea-weed and pumice met with at sea. There should be a microscopic examination of both these means of transport.

CHARLES LYELL.

To SIR CHARLES J. T. BUNBURY.

73 Harley Street, London: July 9, 1867.

My dear Bunbury,—I have been reading your essay on 'South American Vegetation' in 'Fraser' with great interest and profit, and am very glad that Kingsley has succeeded in persuading you to take up your pen again, and let the public benefit by your store of scientific knowledge. It was no easy task to render popular the botany of a country, of which so few even of the genera are known even to a great many who are acquainted with European plants. I re-

member Hooker experiencing the same difficulty in his Himalayan book. But you have managed to make the most of the araucarias and calceolarias and fuchsias, and by describing the Desfontanea in such a way that one can see it.

You have put life into the paper by what you have said of the wide range of some plants, and the discussion whether they are varieties or species, and by the geographical and geological speculation, especially the migrations of plants along the Andes during the glacial period.

I should have liked you to have gone a little more in one direction into the great question of whether species are derivative, or are primordial creations. I was in hopes you would have pointed the moral, when you spoke of two features in South American botany to which you properly call attention. First, the manner in which the vegetation as it goes south from the tropical region of Brazil still continues to be Brazilian, instead of new genera and species fit for temperate latitudes making their appearance; and secondly, the invasion of European immigrants into the Pampas—a wonderful fact, and which would not, I think, have happened if plants were specially created for each country instead of being modified forms of types already there, and dating from an older geological period. It is marvellous how exotic genera thrive best as a rule, both animals and plants, and Darwin has, I think, well explained why. But perhaps this would have led you into too wide a digression, even if you had been as thoroughly imbued with the transmutation creed as I am beginning to be by writing my second volume.

Believe me, my dear Bunbury,
Ever affectionately yours,
CHARLES LYELL.

To CHARLES DARWIN, ESQ.

73 Harley Street: August 4, 1867.

My dear Darwin,—I must write a word before starting to-morrow morning for Paris, to thank you for your last letter, and to say what a privilege I feel it to be allowed to

read your sheets[1] in advance. They go far beyond my anticipations, both as to the quantity of original observation, and the materials brought together from such a variety of sources, and the bearing of which the readers of the 'Origin' will now comprehend in a manner they would not have done had this book come out first. The illustrations of the pigeons are beautiful, and most wonderful and telling for you, and the comparison of the groups with natural families difficult to divide will be most persuasive to real naturalists. The rabbits are famously worked out, osteology and all. The reason I have not got on faster is, that I have been correcting the press of my recast of Mount Etna, which I have reviewed twice since my former edition of fourteen years ago, also the Santorin eruption of 1866, and my grand New Zealand earthquake, which produced more permanent change than any other yet known. I have also had to rewrite my chapters on the 'Causes of Volcanic Heat,' the 'Interior of the Earth,' &c. But all this is in the printers' hands, and I can now give myself to variation and selection.

Believe me, my dear Darwin, ever affectionately yours,

CHARLES LYELL.

To the REV. W. SYMONDS.

73 Harley Street, London : October 20, 1867.

My dear Symonds,—I think I told you last year that Huxley received a specimen of his genus Hyperodapodon (first founded on an Elgin fossil contemporary with Telerpeton and Stagonolepis) from the New Red of the neighbourhood of Warwick. The discovery was made just in time to enable Sir Roderick to cancel and recast some pages of his new edition of 'Siluria,' in which he had defended his old position, that the higher sandstones of Elgin were Old Red. I was pleasantly reminded yesterday of the expedition we made together to the Elgin district by a discovery which Huxley had just made, that among some fossils sent from central India this same Hyperodapodon had made its appearance in those beds studied by Hislop, and which had already

[1] *The Variation of Animals and Plants under Domestication.*

been supposed to be Triassic, because they had afforded us several Dicynodons and Labyrinthodons. You remember that the first Dicynodons found at the Cape of Good Hope by Bain were conjectured by him to be Triassic, but this was thought a mere guess until the same genus was found in India associated with Labyrinthodon. Is it not curious that the united evidence got from Elgin, Warwick, the Cape, and central India should leave so little doubt as to the true age of the beds in all these regions? Charles Moore has found land shells about the age of what they call on the Continent Infra-Lias. The evidence, now that his paper is being printed, seems strengthening. You of course heard that my friend Dawson, requested by me to search in that carboniferous stratum containing *Pupa vetusta* in abundance, has found in it a *Helix* of the sub-genus Zonites. Think what persistent types Pupa and Helix are thus proved to be, and how little we know of air-breathers older than the tertiary which these revelations must convince us existed, though we continue to be so marvellously ignorant of them.

Believe me, my dear Symonds, ever affectionately yours,

CHARLES LYELL.

To DR. BENCE JONES.

April, 1868.

My dear Dr. Bence Jones,—I will endeavour to comply with your request, to give you in writing my reminiscences of Faraday during a short time when I was associated with him on a commission of inquiry. We had been requested by the Government to attend a coroner's inquest, and report on an unusually fatal colliery accident, which occurred in September 1844, at Haswell, about seven miles east of Durham.

Instructions were given us by Sir James Graham, then Secretary of State for the Home Department, and we were to inquire into the causes of the explosion, and if possible to suggest the means of preventing the occurrence of similar catastrophes in future. You will see that it is twenty-four years since the event happened, and although I have occasionally spoken to you and others on the subject, you will make allowance for any shortcomings in my recollections,

when I tell you that I have no notes to refer to, nor any letters written at the time. Various incidents, however, occurred, while we were engaged on this mission, well calculated to draw out Faraday's character, and they made a lively impression on my mind, the more so as I had never had an opportunity of knowing him except in his laboratory, and because I was not prepared to see him play his part with so much spirit and self-reliance, when suddenly launched into a new sphere of action. I had been acquainted with him for many years, and yielded to no one in my admiration of his talents and my appreciation of his scientific eminence ; but I had always looked upon him as a singularly modest and retiring person, and one who would shrink from the stir and responsibility of such an undertaking as that in which we were about to enter. He had in truth undertaken the charge with much reluctance, but no sooner had he accepted it, than he seemed to be quite at home in his new vocation. In a few hours after he had agreed to accompany me, we were carried by a fast railway train to the scene of the catastrophe, and were immediately introduced to the coroner and his jury, who were in the midst of their inquest.

Faraday began, after a few minutes, being seated next the coroner, to cross-examine the witnesses with as much tact, skill, and self-possession as if he had been an old practitioner at the Bar. He seemed in no way put out or surprised when the most contradictory statements as to fact and opinion were given in evidence, according to the leaning which the different witnesses had, whether from a desire to screen or exculpate the proprietors, or be regarded as champions of the pitmen. The chief question was whether any undue considerations of economy had induced the owners of the mine to neglect such precautions as are customary and indispensable to the safety of the men employed in the work.

We spent a large part of two days in exploring the subterranean galleries where the chief loss of life had been incurred, that we might satisfy ourselves whether the means of ventilation had been duly attended to. We conversed freely with the workmen and overseers, and Faraday especi-

ally questioned them about the use of the Davy-lamp. We had both of us been much struck with the uneducated condition of the men examined on the inquest, and suspected that they would not so fully appreciate the dangers to which they were exposed as workmen who were better instructed. Few of them could write, and one even of those who had been promoted to the place of 'master wasteman,' had been unable the day before to sign his name as witness.

Among other questions, Faraday asked in what way they measured the rate at which the current of air flowed in the mine. They said they would show us. Accordingly one of them took a small pinch of gunpowder out of a box, as he might have taken a pinch of snuff, and, holding it between his finger and thumb, allowed it to fall gradually through the flame of a candle which he held in the other hand. A little cloud of smoke began immediately to traverse the space between two of the loose wooden partitions by which the gallery we were in was divided into separate compartments. When the smoke reached the end of the nearest compartment, his companion, who had been looking at his watch, told us how many seconds had transpired, and they then calculated the number of miles per hour at which the current of air moved. Faraday admitted that this plan was sufficiently accurate for their purpose, but, observing the somewhat careless manner in which they handled their powder, he asked where they kept their store of that article. They said they kept it in a bag, the neck of which was tied up tight. 'But where,' said he, 'do you keep the bag?' 'You are sitting on it,' was the reply; for they had given this soft and yielding seat as the most comfortable one at hand to the commissioner. He sprang upon his feet, and in a most animated and impressive style, expostulated with them for their carelessness, which, as he said, was especially discreditable to those who should be setting an example of vigilance and caution to others who were hourly exposed to the dangers of explosions.

As it fell to my lot to examine into the geological structure of the rocks in which the mine was worked, I had engaged several of the men to collect for me the more abundant fossils. When they brought these to me, chiefly

plants, and were very inquisitive about them, I told them what I knew of their characters, and how far they were allied to families of living plants. I entered on this the more fully when I found that my fellow commissioner was no less desirous than the men to be informed on the subject. As I was going away, after having paid the men for their trouble, I was about to throw away all the specimens which had been collected. Faraday, perceiving this, begged me to wait till the men were out of sight, as he said their feelings might be hurt if they saw that nothing had proved to be worth keeping. He had been much pleased with the intelligent curiosity they had shown about the nature of the fossils, and equally struck with their entire want of information respecting them, although it was evident that they had thought and speculated much on the frequency and meaning of such remains in the rocks, and had not been satisfied with the only hypothesis which had been suggested in explanation, namely, that they had been washed there at the time of the Deluge.

Hearing that a subscription had been opened for the widows and orphans of the men who had perished by the explosion, I spoke to Faraday on the subject, and found that he had already contributed largely without having said anything about it to me. He apologised for this, saying that he feared I might think it necessary to give as large a sum as himself, whereas I ought not to be guided by his notions on such matters, which would be generally regarded as peculiar, and which he shared with members of the religious community to which he belonged. In our conversation with the miners we had been often embarrassed by the number of local terms used by them, and by their conflicting statements as to the methods and precautions commonly adopted in the ventilation and management of coal mines. I therefore proposed that we should call in to our assistance an experienced surveyor of mines of my acquaintance, residing in a distant part of the country, one who is now no more, and who, in obedience to our summons, came to us at once. By his help we were rendered much more independent in forming a judgment on several points at issue between the proprietors and the men; but unfortunately our

new assistant, when his services were ended, undertook without communication with us to draw up an elaborate report to the Government, setting forth extensive schemes of his own of legislative interference with the working and inspection of all the coal mines in Great Britain. This he would have sent in to the Secretary of State, as if officially authorised to do so, had we not heard of his intention in time to interdict such a proceeding. Presuming on the kindness with which Faraday had treated him, and the marked mildness and modesty of his manner, he evidently thought he might take the lead as if he had been at the head of the commission, and he must have been surprised at the firm and decisive manner in which his forwardness was checked. On our return to town we found the Home Office besieged with an extraordinary number of letters from individuals, and addresses from local committees formed in the mining districts, each proposing a different plan for the prevention of colliery accidents. Many of the schemes were scientifically unsound, and most of the rest implied such an outlay of money as if insisted upon by law would have led to the shutting up of the mines.

It was natural that Sir James Graham, then fully occupied with his ordinary official business, should wish to refer all these documents to us, while on the other hand we saw clearly that unless we fixed on some limit to the time we were willing to give to duties of this kind, we might be involved for an indefinite period in controversial correspondence on such matters which were equally uncongenial to both of us. Faraday had been engaged in experimental inquiries in which he took a deep interest, when he had thought it right to interrupt them by agreeing to take part in the commission; but he explained to me that no pecuniary remuneration would compensate him for a further suspension of his investigations, and he believed that the improvement in the management of coal mines might be as well or better promoted by others whom the Government might employ. We therefore determined that our labours should cease with the sending in of our report. When this was finished Faraday asked me to sign first, because my name stood first in the commission. I begged him not to insist

on this, as it would place me in a false position, seeing that the brunt of the work had unavoidably fallen to his share, his remarks on the ventilation of mines comprising what was really valuable and original in the report. In fact, my contributions had been restricted to a few words on the geology of the rocks, and some concluding recommendations that steps should be taken to instruct the workmen in the elements of those sciences, such as chemistry, pneumatics, and geology, which were intimately connected with their occupation. My fellow commissioner had agreed with me that the safety of the miners would be increased if they received such instruction, and with more knowledge those prejudices would disappear which always impede the adoption of any change of system. Faraday at last agreed to sign first. It was in fact by mere accident that my name stood before his in the commission, Sir Robert Peel having sent first to me to know if I would go to Haswell, and when I pointed out to him how much more the questions at issue would turn on points of chemistry and physics than on geology, he determined to ask Faraday to go also. Throughout the whole proceeding I found Faraday willing to take more than his share of the work and responsibility, and to be very indifferent as to the amount of credit assigned to him. I was often astonished at the number of hours in the day for which he was able to keep his mind on the full stretch, for I was aware that two or three years before he had been obliged to abstain entirely from mental exertion in consequence of having overtaxed his powers.

Our companionship on this commission left on my mind a lasting impression of the amiability of his temper and the versatility of his genius.

From that time I saw him as frequently as was consistent with his rules of secluding himself from general society, and up to the time of his death he always received me, when we met, on the footing of an intimate friend.

Very truly yours,

CHARLES LYELL.

CHAPTER XXXIX.

APRIL 1868–NOVEMBER 1868.

ANNIVERSARY MEETING AT GREENWICH OBSERVATORY—MR. DAWSON'S 'ACADIA' — BUCKLE AND MOTLEY — VISIT TO TENBY — ON NATURAL SELECTION AND THE MEANING OF COLOUR IN BIRDS — VISIT TO ST. DAVID'S—SUBMERGED FOREST NEAR TENBY—ON THE LAW OF CONTINUITY.

CORRESPONDENCE.

To the Rev. W. S. Symonds.

Southend : April 29, 1868.

My dear Symonds,—I have been going over with much pleasure the geology of the coast sections of Hampshire between Southampton and Poole, and between Poole and Swanage. One cannot too often contemplate the numerous proofs of fresh and shallow water in the dense Purbeck and Wealden strata, covered as they were afterwards by the deep sea of the Chalk, and the splendid leaf beds of the Lower Bagshot with their fan-palms, cinnamon laurels, and ferns, overlaid by the purely marine Barton clay or Upper Bagshot. The ferns of these Eocene pipeclays retain not only their *sori*, but in each dot or fruit bag you can, under a powerful microscope, count the spores as distinctly as in the fruit of a living frond. The Purbeck beds are not only rippled, but the calcareous slabs have preserved on their under side fine casts of the sun-cracks of the clay beds below. I carefully examined in the cliff that single dirt bed, or old soil, only six inches thick, in Durlston Bay near Swanage, in which Brodie and Beckles found more than a dozen species of mammalia. There is no discovery which to my mind speaks so eloquently of the fragmentary nature of the record, and of the know-

ledge that may one day be rescued even from the shreds which have been spared to us, than this thin, ancient layer at the base of the Middle Purbeck. Whenever you have an opportunity, visit the Blackmore Museum at Salisbury, and get Mr. Stevens, the curator, to show it to you. Even since I mentioned it, I found some splendid antlers of the reindeer at Fisherton, that grand repository of a paleolithic fauna. I am delighted at the idea of your being with Leonard and me at Tenby. I hope to attend the first half of the British Association, which will begin at Norwich August 19.

Sincerely yours,

CHARLES LYELL.

To PROFESSOR HEER.

73 Harley Street, London: June 7, 1868.

My dear Heer,—Yesterday we had our anniversary meeting at the Greenwich Observatory, and one of the astronomers remarked to me, that although the inclination of the earth's axis must have been constant for such periods of moderate duration, as for example, a few tens of thousands of years, yet if you come to millions, there is nothing in the facts at present observed in astronomy to preclude the supposition of a change in the axis. I told them not to go too fast, for although the flora arctica showed a luxuriant forest vegetation near to the pole, and vines in high latitudes, there were as yet no fan-palms, much less a Phœnix palm, as in the Miocene of Switzerland, so that if they could place the polar circle under or near the equator in Miocene times, they might create as many difficulties as they would remove.

What you told me in your letter of April 7 of your 'Flora Baltica' was very interesting. I got so well acquainted with the deciduous cypress, or *Taxodium distichum*, in the swamps of the Lower Mississippi, that your finding that very species in the brown coal of the north of Europe makes me seem to understand the state of things which then prevailed. I am only afraid that a hundred species of these fossils will give you too much hard work. I am glad you are able to com-

pare some of the Bovey Tracey species with those of other regions.

Believe me, my dear Heer, ever truly yours,

CHARLES LYELL.

P.S. I ought to have thanked you for your beautiful paper on the 'Chalk of Moletrin in Moravia,' and for the beautiful plates which illustrate it.

To PRINCIPAL DAWSON.

London: July 1, 1868.

The new edition of your 'Acadia' is a work of which you may well feel proud, and I am much pleased with the re-dedication of the book to me. I have not yet had time to study the chapters on the 'Fossils of the Carboniferous and Devonian Rocks;' you did well to give a restoration of the flora of the latter in the frontispiece, not omitting the insects. It marks the great step which has been made in our science in twelve years, and it is remarkable, as you say, in how many points Acadia is prominent in geology, even if, as I suspect, the *Eosaurus* may turn out to be *Labyrinthodont*. The *Conulus* is also a grand addition, and a wonderful proof of a persistent type.

In regard to the antiquity of man, I have great faith in the judgment of the Danish naturalists as to the long duration of the Neolithic period in their country. The extensive peat bogs have been well searched, and although they cannot draw a precise line between the accumulation of peat in the last eighteen centuries, and that of pre-historic date, they can yet form a tolerably correct notion of the relative importance of the accumulation of the two periods. To suppose a rotation of crops in the forest trees to have been brought about by general conflagrations is too catastrophic to suit my notions, and would require some monuments of the work of fire. The absence in all Scandinavia, where they have collected so many thousands of implements, of a single specimen of the paleolithic type of oval hatchets, or spear-shaped unpolished tools, is a very strong negative proof of man not having entered that country in the ancient period of the mammoth. Farther south the evidence is steadily

augmenting in favour of the great geographical changes which have taken place since England, France, and other parts of Europe were inhabited by the earliest fabricators of the paleolithic tools.

The Duke of Argyll has argued in an article in 'Good Words,' that as the stone period of the Esquimaux coincided in date with the iron period of London and Paris, so the ancient flint folk north of the Alps may have been contemporary with men of a more advanced civilisation farther south, and he wishes to make out that the stone age may be connected with degradation, and the driving out of a surplus population into regions having the worst climate. But when we go south of the Alps, and examine the drift containing the bones of mammoth and other extinct mammalia, as at Rome, or near Madrid, or in Sicily, we find stone implements of the ancient type instead of the monuments of an iron age. Lately, in the Presidency of Madras, our Indian surveyors have found on the coast a bed of Laterite at the height of 500 feet above the sea level, containing quartz hatchets marvellously similar in size and shape to the flint implements of Amiens. Certainly there are no signs in warm latitudes of a civilisation like that of old Nineveh or Egypt having flourished at such a remote date as to allow of great subsequent changes in climate, or in physical geography, or in the mammalian fauna.

What think you of the alleged discoveries going on in the American continent, or in the auriferous gravel of California, in which bones of Mastodon, according to Dr. Snell, together with some implements, were found in the deep places of Table Mountain? These old alluviums have in one respect a more ancient aspect than our higher level valley gravels, as they belong to a period when the drainage was more distinct in direction from that of the present rivers. This, however, would not prove a higher antiquity, because the overlying basaltic lava shows that great volcanic action was going on in the same country, which would greatly accelerate geographical changes. You have done well to point out that there was a stone and reindeer period in Nova Scotia, only three hundred years ago, in the latitude of central and southern France.

What you have written on the glacial period I like much,

and I am sometimes disposed to attribute the numerous lakes of your country to submarine current and ice action, but I do not see my way as yet. I should like to know what may be the velocity of these currents at the bottom.

CHARLES LYELL.

To LADY BUNBURY.

73 Harley Street: July 26, 1868.

Dearest Frances,—I have just been installed in my new chair, which they have adjusted beautifully to my height and other requirements, and when I am tired of reclining on the sofa which you gave me, I shall be glad to indulge in sitting in this new piece of furniture which you have so kindly added to my study. Many thanks, dear Frances, for thinking of such luxuries for me. I have also to thank your husband for having referred me to Buckle on the 'Conversion of Henri IV.' It is really curious to compare the parallel passages in Buckle and Motley. That in Buckle is exceedingly eloquent, and has of course some truth in it, but the tone of morality in Motley is higher. I only get on with the latter by snatches, but am very much interested. I agree with Charles in wondering whether Philip II. could possibly have deceived himself to such an extent as to believe he never injured any man knowingly. The historian is evidently much puzzled, and tries to make out that he thought himself a god, and there may be something in that. When Motley sums up all his misdeeds, I rather wondered that he omitted that glaring act of repudiation of all his heavy pecuniary obligations which he was guilty of a year or two before his death. The misery he must have caused by that was so great that it might have made him think he had injured some even among the most orthodox of his subjects. It helped to explain to me how the military power of Spain failed to crush the Dutch republic. The narrative of the polar voyages was very new to me. The siege of Ostend very well told; such a skilful suppression of uninteresting details. If you have not read it, do indulge in this history.

Believe me your affectionate brother,

CHARLES LYELL.

To PRINCIPAL DAWSON.

73 Harley Street: July 31, 1868.

My dear Dawson,—I hope that long before this you have got my letter, written in the beginning of this month, in which I spoke of the first part of your 'Acadia,' which I have since been reading steadily with increased pleasure and profit, and which I find Etheridge is reading with equal satisfaction. It is so full of original observation and sound theoretical views, that it must, I think, make its way, and will certainly be highly prized by the more advanced scientific readers.

I think Huxley's doctrine of Homotaxis [1] would never have been put forth in such strong terms had he been more of a field geologist. What we have to remember is, that our records are so fragmentary; that at several intervals all memorials of minor periods of vast duration, as measured by centuries, may be wanting; and on comparing the coal-period of New South Wales or China with that of Nova Scotia, it is conceivable that no one stratum or set of strata in one of these regions may be strictly contemporaneous with any one in the other region. But the whole may have been formed in all three areas between the close of the Devonian and the beginning of the Permian periods. The more our Indian surveyors advance, the more do they become persuaded that they have in the Himalaya counterparts of several of our European subdivisions of the Lias and Oolite, and on comparing the northern and southern hemispheres, the proofs of real contemporaneity of similar formations, as opposed to homotaxis, are growing stronger.

You have done well to give that wonderful section of the South Joggins in detail. I certainly think that a thickness of 16,000 feet implies the existence and waste of great continental areas and of large deltas. The evidence of subaerial conditions is overwhelming, and I always think with pleasure of the privilege of having seen in the Great Dismal

[1] 'Similarity of Arrangement.' See Anniversary Address to the Geological Society, 1862, by Professor Huxley.

Swamp such accumulations of pure vegetable matter going on, and hundreds of fallen and prostrate trees rotting away. I am also glad to have observed, near New Madrid, so many areas where hundreds of erect trees submerged ever since the earthquake of 1811, are still standing erect and leafless in the water.

What amount of subsidence must we imagine to allow of the superposition of strata 16,000 feet thick? Must we have a sinking to that amount? In all great deltas the tendency of conversion into dry land by the deposition of sediment must be counteracted in those areas where there is a suspension of such deposition by the condensation of mud into shale, loose vegetable matter into coal, and loose sand into more compact sand and sandstone. When, therefore, fifty generations of your Sigillaria have accumulated uninterruptedly, there will have been a subsidence owing to the materials below having been gradually pressed down and packed into a smaller space, quite independently of a general sinking down of the earth's crust in that quarter. This may help the coming on of those conditions which produced the lagoons in which the Naiadites and Serpula flourished.

I had forgot to say how surprised I was that Leslie, whom I have seen lately here, should have raised such strange objections to some of your conclusions. We know over how vast an area the Appalachian coal-measures extend. Suppose them to be 3,000 feet thick, and that the rate of subsidence was two and a half feet in a century, as soon as the river or rivers coming from where the Atlantic now is filled up a certain space, it would push the delta farther on; but if the rate of sinking was five feet instead of two and a half, the mass of sediment deposited would be thicker near the old land, instead of a larger area of sea being reclaimed. If the Nova Scotia coal-measures are thicker than those of other regions, it does not prove that the quantity of mud and sand was greater, but that the rate of sinking was such as to cause the deltas to be limited in horizontal extension. I cannot see what objection there can be to isolated basins; there may have been many independent rivers, like those which enter the Gulf of Mexico. If different coal-basins of the United States resemble each other,

as I presume Leslie means to say, it ought to be a relief to him to find Nova Scotia is exceptional as to thickness; for a general uniformity would be the real puzzle, for it would imply that corresponding movements in the earth's crust extended simultaneously over a large part of the northern hemisphere, of which we have no counterpart in the present state of things.

Ever yours,
CHARLES LYELL.

To the REV. W. S. SYMONDS.

Tenby: September 10, 1868.

My dear Symonds,—As my sister, Mrs. Lyell, is writing to you, she will tell you about my brother's illness and the consequent uncertainty of our stay here. If he recovers I shall hope to carry out our scheme of seeing something of the geology of this part of the world with you, and you will give us as much notice beforehand as you can of your own intended movements. I should like much to know what you think of the relations of the strata here, and with those of Devonshire. The limestone on which Tenby stands was called by De la Bêche carboniferous, and the few fossils which I have seen from it, such as *Productus Scoticus*, seem to confirm that view. Then the true coal-measures overlie. The millstone grit I have not yet been able to make out, but there is a break in the section of the cliff here between the mountain limestone and the coal, in which there may be sandstone and grit which I may find in the interior. Below the mountain limestone at Manorbier, we saw yesterday some 500 or 600 feet of vertical red shale and red sandstone, with some beds of green shale, and a few whitish beds of quartzose grit; this is named by De la Bêche Old Red, which it resembles exactly, and though we saw hundreds of strata finely exposed, we could not see a single fossil in it. But at the junction of this formation and the carboniferous limestone at Skrinkle Haven, nearer to Tenby than Manorbier, there are several hundred feet of fossiliferous beds, in which limestone, red shale, quartzose grit, conglomerate, blackish shale, alternate again and again, many of the beds containing teeth and scales of fish, some of them Orthis and

Rhinconela, which we have not had time to collect in, and see whether the fossils are Carboniferous or Devonian. If they are not Devonian, are we to conclude that in going from Devonshire to Pembrokeshire all the Devonian beds are lost, and nothing but the true Old Red left between the Silurian and Carboniferous? I forgot to say that in the junction bed there are ripple-marked sand and shrinkage cracks, showing what shallow water preceded the deep-sea condition of the carboniferous limestone, in which last we have seen several corals, especially Caryophylia.

Mr. Smith of Gumfreston says the limestone here is divisible into three masses, one of them, qy. the uppermost, characterised by Encrinites, another by Corals, and among them *Lithostrotion basaltiforme.*

Leonard is working away both at the recent shells and older rocks. The first three days more than fifty species of the former picked up on the beach, and their number always increasing. They throw much light on the Crag. They who study tertiary geology, and who do not begin at this end, are like children taught Greek and Latin before they have learned a word of English.

I am summoned to join a party.

Believe me ever most truly yours,

CHARLES LYELL.

To the DUKE OF ARGYLL.

Tenby: September 19, 1868.

My dear Duke of Argyll,—I have just read with great interest your spirited and clearly written article in reply to Wallace on 'Nidification.'[2] If I did not feel sure that portions of it will be embodied in some of your future works, I should grudge its being placed in a periodical just struggling into existence, though it may perhaps be most usefully published in the same journal as the paper which it controverts. I objected in my 'Antiquity of Man' to what I there called the deification of natural selection, which I consider as a law or force quite subordinate to that variety-making or

[2] 'A Theory of Birds' Nests,' by Alfred R. Wallace. *Journal of Travel and Natural History*, No. 2.

creative power to which all the wonders of the organic world must be referred. I cannot believe that Darwin or Wallace can mean to dispense with that mind of which you speak as directing the forces of nature. They in fact admit that we know nothing of the power which gives rise to variation in form, colour, structure, or instinct.

But before Darwin had written his first work, I used to maintain that there was a meaning and utility in every one of the marks and shades of colour in the butterfly's wing, and I still think so. It may be inherited after it has ceased to be useful or indispensable. The explanation offered by Darwin of the dull colour of most female birds appears to me a great step. The assumption that birds and mammalia of the same species vary in colour both in a wild state and under domestication is not imaginary, but founded on fact. A breeder might give rise to a race of white pheasants; but natural selection would not allow of such a race, because they would be too conspicuous, at least under ordinary conditions, and in the present state of the world. How far sexual selection is one of the causes of modification of colour is a point on which I never could form any opinion. I was surprised when I first saw the importance which Darwin attached to it. He seemed to me to exaggerate at least its probable influence. It does not strike me that Wallace's theory requires that there should be a tendency whether in cocks or hens to produce bright hues, but merely that in the course of time, and among the millions which will be born, individuals will be gifted with plumage of every tint from the brightest to the most dull, and that those varieties that are ill suited for the conditions prevailing at any given time or place will be killed off, while the fittest will survive. There is no necessity of supposing any consciousness on the part of the birds of the bad effects which certain conspicuous colours would produce.

That we should ever come to know so much of the system of nature as to be able to give a reason for each particular variation of colour is more than could be expected; but Darwin has been making vast progress in this direction, and the discovery that plants with bright and conspicuous flowers require the aid of insects to fertilise them, while

those which are inconspicuous are fertilised by the wind, appears to me a grand generalisation. I believe he also finds that the odoriferous plants, and those which afford honey, require insects for their impregnation.

What you say of hereditary habit being in each individual as independent of experience or observation as are instincts, is most true; but if we could trace such a habit to a remote progenitor, and show that he acquired it under some new conditions in the physical world to which he was subjected, the insight thus gained into the history of the origin of certain instincts would be a great gain to the naturalist.

Although the advocates of natural selection often ascribe too much to that one cause, it has enabled them at any rate to assign a reason for many phenomena which would never have been brought to light by those who are satisfied with saying that all things were pre-ordained to be as they are. You are certainly not one of that school, and it appears to me that the reason which you assign why some of the smallest birds having sombre and neutral tints build dome-shaped or covered nests is very satisfactory, and so far as I know, original, and I shall be curious to know whether Wallace will not be forced to admit that in all these cases it is a better theory than the one which he had proposed.

In some of the passages which you have cited from Wallace you have shown that he is obscure and perhaps illogical. In others the discordance of opinion arises, I suspect, from the fundamental difference of the point from which each of you start. The assumption of special creation would make the origin of all things simple; but if once a naturalist taking all the geological evidence into account inclines to the opposite view, that of transmutation, as more probable, we are led to speculate on the manner in which the present instincts, habits, structure, and colour came to be gradually acquired by each species, living under the surrounding conditions which are not those that prevailed in the period immediately antecedent. The transmutationist may reasonably hope that we shall get to understand more and more the working of those forces by which nature brings about changes in the organic and inorganic world. The part played by natural selection, which was almost en-

tirely overlooked by Lamarck, is evidently very important, and I now indulge a hope that the working of other secondary causes, hitherto not attended to, will help to explain many perplexing phenomena which these who are satisfied with special creation would never bring to light.

We are much relieved by hearing this morning from Arthur Milman a decidedly better account of the Dean of St. Paul's.

Believe me, my dear Duke, ever most truly yours,

CHARLES LYELL.

To the REV. W. S. SYMONDS.

Tenby: September 28, 1868.

My dear Symonds,—I have just returned with Leonard from a very successful expedition to St. David's, where Dr. Hicks devoted the best part of three days to show us some 2,000 feet of strata, most of them fossiliferous, lying below the original 'lingula flags' of Sedgwick, which last I have always held to be the only rocks for which the Cambridge Professor had any right to claim his name of 'Cambrian,' as distinguished from Sir Roderick's 'Silurian.' Within the last two months Dr. Hicks has found in purple shales mineralogically like those of the Longmynd, organic remains (a new Lingulella and a bivalve entomostracan) 1,200 feet below the fossils previously discovered. Higher up in the Lower Cambrian series are twelve genera of Trilobites, &c., like those of Barrande's primordial, but one or two new forms and many new species; one species of Paradoxides more than twenty inches in length; all in the ancient azoic. I was much pleased with the sight of the raised beach at the NE. end of Caldy Island, with its pebbles and littoral shells some fifteen feet above high water mark. Leonard also took me to a good example of the same beach at Giltar Point, with littoral shells, and there are three layers separated by blown sand of full-grown eatable shells at the top of Giltar Point, apparently refuse heaps of the ancient molluscophagous inhabitants; these, I suppose, are nearly 200 feet high. He has also found a raised beach at the top of

Merlin's Cave, a cavern in the limestone in the cliff near the western suburbs of Tenby.

When there are raised beaches and submerged forests, it is difficult enough to restore in imagination the succession of geographical changes. The difficulty becomes greater when you have to make due allowance for the relative age of two other sets of phenomena, viz. the glacial drift and the lines of lofty cliffs bounding the present sea, and sometimes undermined by the waves.

I made two attempts to dig through the submerged forest of Amroth at low tide. The first day we went down five feet without going through the beds containing vegetable matter. The second day, nearer the cliff, Leonard got to what seemed a sea beach, after passing through the beds containing the stumps and roots of trees, at the depth of about four feet.

Dr. Hicks says that in the absence of marine shells we ought not to assume that a bed of clay or mud with sub-angular and rounded pebbles was an old beach like the present, because it may have been glacial 'till' with boulders. In support of this view he says that the submerged forest of Whitesand Bay certainly grew on 'till' containing glaciated stones, and I remember seeing 'till' with true arctic shells at about the level of the sea at the Great Orme's Head, and there are submerged forests in that neighbourhood.

When you say that the old forest extended across the Bristol Channel, which I think highly probable, do you suppose that the lofty cliffs of Ilfracombe and of Tenby and its neighbourhood were not only in existence, but were even of pre-glacial date?

Believe me, my dear Symonds,

Ever most truly yours,

CHARLES LYELL.

To PROFESSOR HAECKEL.

London: November 23, 1868.

My dear Sir,—I have to thank you for your kindness in sending me a copy of your important work on the 'History of Creation,' and especially for the chapter entitled 'On

Lyell and Darwin.' Most of the zoologists forget that anything was written between the time of Lamarck and the publication of our friend's 'Origin of Species.'

I am therefore obliged to you for pointing out how clearly I advocated a law of continuity even in the organic world, so far as possible without adopting Lamarck's theory of transmutation. I believe that mine was the first work (published in January 1832) in which any attempt had been made to prove that while the causes now in action continue to produce unceasing variations in the climate and physical geography of the globe, and endless migration of species, there must be a perpetual dying out of animals and plants, not suddenly and by whole groups at once, but one after another. I contended that this succession of species was now going on, and always had been; that there was a constant struggle for existence, as De Candolle had pointed out, and that in the battle for life some were always increasing their numbers at the expense of others, some advancing, others becoming exterminated.

But while I taught that as often as certain forms of animals and plants disappeared, for reasons quite intelligible to us, others took their place by virtue of a causation which was beyond our comprehension; it remained for Darwin to accumulate proof that there is no break between the incoming and the outgoing species, that they are the work of evolution, and not of special creation.

It was natural, as you remark, that Cuvier's doctrine of sudden revolutions in the animate and the inanimate world should lead not only to the doctrine of catastrophes, such as Elie de Beaumont's sudden formation of mountain chains, but to a similar creed in regard to the organic world. A. D'Orbigny gave us twenty-seven stages or groups of living beings, all the species in each of which were so distinct that none of them passed from one to the other stage. Agassiz still inclined to the same notion, the sudden annihilation of one set of inhabitants of the globe, and the coming upon the stage in the next geological period of a perfectly distinct set. I had certainly prepared the way in this country, in six editions of my work before the 'Vestiges of Creation' appeared in 1842, for the reception of Darwin's gradual and

insensible evolution of species, and I am very glad that you noticed this, and also the influence of Cuvier's work, which in an English dress, translated by Professor Jamieson, went through almost as many editions in this country as in France, and exercised great authority long after my 'Principles' began to be popular. No part of your new work has produced such an effect as the pictures of the embryological state of man and the dog at corresponding ages, and figures of man, dog, tortoise, and fowl in the embryo. I am surprised to observe how much even very good naturalists are persuaded by the evidence of these woodcuts, as if although they previously had admitted the analogy, they had never thoroughly felt the force of it till they saw the facts as represented by you. Some of those to whom the ape origin of man is a very unwelcome doctrine, have tried to lessen the effect of these woodcuts by saying they must be a little flattered, like the physiognomies of men and apes given in your frontispiece, for some of these last are accused of being caricatures, the artist being supposed to have put a little too much of the ape into the human, and of the man into the Simian countenance and features.

For my own part I think I would rather have seen the embryological figures in the frontispiece. I think they would have induced a greater number to become readers, and would have inspired more faith, but perhaps the publisher would be of a different opinion. It is one of those cases in which one would like to have the real photographs of each countenance, as there could not then be any cavilling, however great the resemblance between the two portraits.

CHARLES LYELL.

CHAPTER XL.

APRIL 1869–FEBRUARY 1875.

GEOLOGY ON THE COAST OF NORFOLK—MR. WALLACE'S REVIEW ON NATURAL SELECTION—GLACIERS SCOOPING OUT LAKE-BASINS—FOSSIL FLORA OF ALASKA—'LIFE OF DANIEL WEBSTER'—DEATH OF HIS WIFE—FORFARSHIRE GEOLOGY—MR. JUDD ON 'GEOLOGY OF MULL'—HIS DEATH—DR. HOOKER'S LETTER—FUNERAL—WESTMINSTER ABBEY—TRIBUTE.

[He made excursions to Norfolk and Suffolk in 1869, and later on to Westmoreland on his way to Forfarshire, and thence he made an expedition with Lady Lyell and his nephew to Ross-shire by Inchnadamff and Ullapool, returning by the parallel roads of Glen Roy.

In 1870 he visited Dunster, Minehead, and Ilfracombe in Somersetshire, and in August went to Scotland, to the Isle of Arran, and after spending some weeks at Ambleside joined the British Association at Liverpool.

In April 1871 he made a tour in Cornwall, to Tintagel, the Land's End, and Penzance, and in the following summer he spent some time in Yorkshire and Westmoreland.

In April 1872 Sir Charles and Lady Lyell went to the south of France, to the Caves of Aurignac. In these last journeys, when his sight and bodily powers had become more enfeebled, he enjoyed the advantage of the companionship of Mr. Hughes,[1] whose zeal for geology and whose powers of observation rendered him a most useful as well as agreeable fellow-traveller.

In the spring of 1873 Sir Charles had the affliction of losing his beloved wife, his companion and helpmate, with whom he had had forty years of unbroken happiness.

This severe blow fell heavily on his already broken health, but to his science alone he felt he must turn, to arouse him for the short time he had yet to live, and he determined to fulfil what he had planned with her; so calling on the friend who had promised again to accompany them, and with a sister (who devoted herself to him for

[1] T. M'Kenna Hughes, Esq., Woodwardian Professor of Geology at the University of Cambridge.

the rest of his days), he went abroad this autumn, and visited his friend Professor Heer of Zürich.

In June 1874 he went to Cambridge, to receive the honorary degree of LL.D., and that same month was admitted to the freedom of the Turners' Company in the City of London. He then spent some weeks in Forfarshire, and found pleasure in visiting some of his earliest geological haunts, and in finding that his theories of fifty years past still held good. He invited Mr. Judd [2] to join him, and went with him to several points of interest.

On November 5, the fiftieth anniversary of the Geological Society Club, of which he had been a member from its foundation, he attended the dinner, and spoke with a vigour which surprised his friends.

His failing eyesight and other infirmities now began to increase rapidly, and towards the close of the year he became very feeble. But his spirit was ever alive to his old beloved science, and his affectionate interest and thought for those about him never failed. He dined downstairs on Christmas Day with his brother's family, but shortly after that kept to his room.]

CORRESPONDENCE.

To Sir Charles Bunbury.

Cromer: April 6, 1869.

My dear Bunbury,—I will dictate a few lines to you on the geology which Leonard and I have been seeing since April, when we went to Aldborough, where we resumed the work which was interrupted last year by the British Association meeting at Norwich.

From Aldborough we went by Southwold to Lowestoft, seeing the coast at Kessingland and Pakefield by the way. It is a great satisfaction to see a continuous section for miles unbroken of such deposits as one only gets a peep of in isolated pits in your county, without any means of guessing their relative age. We first had this advantage in the cliff at Easton Bavent, where the yellow sands and gravel beds of Lord Stradbroke's park at Henham and Wangford are well displayed. But I wished much I could have had the advantage of walking with you along the Kessingland and Pakefield cliff, about fifty and sixty feet high, where at

[2] Now Professor of Geology at South Kensington School.

the base for more than a mile, in a bed of what I formerly called green till, a homogeneous unstratified clay, I found upright plants or shrubs, standing vertical with their roots in the same green soil (apparently tap-roots), also vertical and a foot or more long. In one place, near Pakefield, this lower stratum was laminated, and contained prostrate flattened trees, a foot or more in diameter. Over this green till, with plants *in situ* (of which I have kept a few specimens to show you), reposes stratified sand many yards thick, and over this drift, with plicated boulders of chalk, lias with fossils (*Avicula cygnipes*), numerous ammonites, belemnites, pieces of mica-schist, sandstone, greenstone, and other rocks. It is strange to see this glacial drift covering the bed for a mile and a half with trees which must have grown *in situ*, and must have sunk down so as to allow first the sand, and then the boulder clay to accumulate over it.

We could find no shells, freshwater or marine, with the plants. But in the Norfolk cliffs at Happisburgh, about sixty feet high, we found a different kind of drift, the matrix of which is a green clay much resembling in appearance, and in being generally without laminæ or stratification, the Pakefield plant-bed, but containing boulders of all kinds, with numerous pieces of chalk and chalk-flints, many of the rocks well glaciated. But although, when washed out of the till, they formed fine piles on the beach, they are so sparse as not to interfere with the general green colour of the mass. In a bed of gravel, two feet thick and several yards long, in the middle of this green till, we found a bed of pebbles like a fragment of an old beach, with a single valve of *Tellina solidula*, perfect, and some pieces of *Cardium edule*. In the same green boulder clay, on both sides of Happisburgh, we found small pieces of the same *Cardium*, and of what seemed to be *Cyprina Islandica*, and one perfect valve, but usually only small pieces of the Tellina, and no other shells whatever, in this glacial drift. I suppose therefore we must set it down as a marine formation; and underneath it, from Happisburgh to Cromer, comes the famous lignite bed and submarine forest, which must have sunk down to allow of the unquestionable glacial formation being everywhere superimposed.

We found the lignite during a walk along the cliffs this morning, and were shown the place where prostrate trees and some stumps of the forest were exposed by some recent high tides, though they are now buried again under shingle and sand. We also found ferruginous or reddish-coloured concretions with dicotyledonous leaves, which, though we did not find them *in situ*, must, I suppose, have come from the lignite or forest bed, from which I suppose Heer might in time construct a flora to add to the spruce fir, Menyanthes, &c.

Leonard and I have just returned from Sherringham, where I found that the splendid old Hythe pinnacle of chalk in which the flints were vertical, between seventy and eighty feet high, the grandest erratic in the world, of which I gave a figure in the first edition of my 'Principles,' has totally disappeared. The sea has advanced on the lofty cliff so much in the last ten years, that it may well have carried away the whole pinnacle in the thirty years which have elapsed since our first visit.

We are going to-morrow to revisit Mundesley.

Believe me ever, with love to Frances,

Affectionately yours,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

May 5, 1869.

I am pleased at the impression which the historical part of Wallace's review[3] made on you. It reminds me of Cuvier's daughter, a charming and intelligent girl, telling me she had been reading my book (vol. i. of 'Principles') to her father, and that they had been struck with the complete antagonism of my views to those which he had propounded in his 'Theory of the Earth.'

I was always made to feel myself a welcome guest at Cuvier's *soirées*, but he never alluded to my book, and but for Mademoiselle Cuvier's saying she had been reading it to him in their carriage as they drove out, I should never have known he had seen it.

[3] 'Geological Time and the Origin of Species.' *Quarterly Review.*

I quite agree with you that Wallace's sketch of natural selection is admirable. I wrote to tell him so after I had read the article, and in regard to the concluding theory, I reminded him that as to the origin of man's intellectual and moral nature I had allowed in my first edition that its introduction was a real innovation, interrupting the uniform course of the causation previously at work on the earth. I was therefore not opposed to his idea, that the Supreme Intelligence might possibly direct variation in a way analogous to that in which even the limited powers of man might guide it in selection, as in the case of the breeder and horticulturist. In other words, as I feel that progressive development or evolution cannot be entirely explained by natural selection, I rather hail Wallace's suggestion that there may be a Supreme Will and Power which may not abdicate its functions of interference, but may guide the forces and laws of Nature. This seems to me the more probable when I consider, not without wonder, that we should be permitted to give rise to a monstrosity like the pouter pigeon, and to cause it to breed true for an indefinite number of generations, certainly not to the advantage of the variety or species so created.

At the same time I told Wallace that I thought his arguments, as to the hand, the voice, the beauty and the symmetry, the naked skin, and other attributes of man, implying a preparation for his subsequent development, might easily be controverted; that a parrot endowed with the powers of Shakspeare might dictate the 'Midsummer Night's Dream,' and that Michael Angelo, if he had no better hand than belongs to some of the higher apes, might have executed the statue of Lorenzo de' Medici.

In reply to this and other analogous comments, Wallace said: 'It seems to me that if we once admit the necessity of *any action* beyond "natural selection" in developing man, we have no reason whatever for confining that action to his brain. On the mere doctrine of chances, it seems to me in the highest degree improbable that so many points of structure all tending to favour his mental development should concur in man, and in man alone of all animals. If the *erect posture*, the freedom of the *anterior* limbs for *purposes of locomotion*, the

powerful and *opposable* thumb, the naked skin, and *the great symmetry of force*, the *perfect organs of speech*, and his mental faculties, *calculation of numbers*, *ideas of symmetry*, of *justice*, of *abstract reasoning*, of *the infinite*, of *a future state*, and many others, cannot be shown to be each and all *useful* to man in the very lowest state of civilisation, how are we to explain their co-existence in him alone of the whole series of organised beings? Years ago I saw a Bushman boy and girl in London, and the girl played very nicely on the piano. Blind Tom, the idiot *Negro*, had a *musical ear or brain*, perhaps superior to that of any living man. Unless you can show me how this rudimentary or latent musical faculty in the lowest races can have been developed by survival of the fittest, can have been of *use* to the individual or the race, so as to cause those who possessed it to win in *the struggle for life*, I must believe that some other power caused that development, and so on with every other especially human characteristic. It seems to me that the *onus probandi* will lie with those who maintain that man, body and mind, could have been developed from a quadrumanous animal by natural selection.'

As to the scooping out of lake-basins by glaciers, I have had a long, amicable, but controversial correspondence with Wallace on that subject, and I cannot get over (as, indeed, I have admitted in print) an intimate connection between the number of lakes of modern date and the glaciation of the regions containing them. But as we do not know how ice can scoop out Lago Maggiore to a depth of 2,600 feet, of which all but 600 is below the level of the sea, getting rid of the rock supposed to be worn away as if it was salt that had melted, I feel that it is a dangerous causation to admit in explanation of every cavity which we have to account for, including Lake Superior. They who use it seem to me to have it always at hand, like the 'diluvial wave, or the wave of translation,' or the 'convulsion of nature or catastrophe' of the old paroxysmists.

I have just got a letter from Professor Leslie, and an important paper by him in the American 'Philosophical Society' for 1862, and another on a projected map, 'intended to illustrate five types of earth-surface in the United States,' published in 1866. He was formerly a catastrophist, but of

late years he seems to have anticipated Geikie and Croll in regard to sub-aerial denudation, giving, like them, too little to the sea. But he is a man intimately acquainted with the Appalachians, and he gives his reasons for not believing that the ice-sheet has had any hand in eroding the Appalachians. It has polished the surface, and carried erratics so far as mid-Pennsylvania, and no farther; but the surface erosion is just as great in Southern Pennsylvania and Virginia, &c., which was not reached by the ice, and where there is not a single glacial scratch or groove. He says that the large map which he has planned will make the ice-scooping of lakes in the United States appear as absurd as if applied to tropical Africa or the Albert Nyanza Lake.

Believe me ever affectionately yours,

CHARLES LYELL.

To PROFESSOR HEER.

73 Harley Street: November 4, 1869.

My dear Heer,—I ought sooner to have acknowledged the receipt of your beautifully illustrated paper from the 'Fossil Flora of Alaska,' which I have looked at with more interest from what you told me in your letter of the light which it throws on the isothermals of the Miocene period.

That this flora should have ranged with so little variation over 10° of latitude in the Miocene period, will have a great bearing on those who are ready with so little ceremony to shift the place of the earth's axis of rotation when it suits their theoretical views. The late deep sea dredging expeditions to the Faroe Islands have shown that in our northern sea, cold and warm areas occur at the depths of from 2,000 to 3,000 feet below a surface having a uniform temperature, and from which such a variation of climate would not have been expected. These different climates occur in the same latitudes in areas sometimes fifty, sometimes less than twenty geographical miles apart. The marine fauna consists of distinct species in the cold areas where the current comes from the North or the Arctic regions, and in the warm areas where the water is brought from the South or Gulf-stream. It is only a small proportion of cos-

mopolitan species and genera which are common to the two distinct climatal areas. Last year they came away with an idea that the cold areas where the water is about 30° Fahr. were very barren of organic remains, but a totally new dredging apparatus has shown that this was a great error. They have also visited a region 260 miles south of the island of Ouessant in the Bay of Biscay, where the depth was 15,000 feet, or within a very few feet of that depth, the same as the height of Mont Blanc, and they have found abundance of life of different classes at this enormous depth.

As you will soon see more particulars in the 'Proceedings of the Royal Society,' I will not attempt to give you more of what I have learnt from conversation with the dredgers.

Believe me, my dear Heer, ever most truly yours,

CHARLES LYELL.

To GEORGE TICKNOR, ESQ.

May 31, 1870.

My dear Ticknor,—I have been reading with great interest the eloquent passages which you pointed out in the 'Life of Daniel Webster' by Mr. Curtis. Such eulogies from two men of such weight, and addressed to a large public during a man's lifetime, are a splendid monument to his memory.

I go out as little as possible, as I like to go to bed at nine o'clock, and it is scarce any use to start now for an evening party till half-past ten o'clock. We were asked to an evening at the Van de Weyers', to meet the King of the Belgians, and it was no loss to me to learn that they were obliged to put off the party because some previous balls had caused a crack in the wall of their house, and a surveyor said that an additional weight would bring the rooms down. The Motleys gave a grand reception to the king in the same street, which Mary went to.

But to return to Curtis's 'Life of Webster.' I have been too busy with my own new edition of the 'Elements of Geology,' to be able as yet to do more than turn over the pages, but I was surprised to see in a note at p. 586, that

woman's suffrage was a matter already familiarly discussed in 1852 on your side of the water. We have heard a great deal of it lately on our side, and though I approve of much in J. S. Mill's 'Subjection of Women,' and have always thought that there was much to rectify in our legislature, I confess I should look with alarm if I thought a great extension of suffrage should take place, including women as well as men. We should never have passed the disestablishment of the Irish Church, if the vote of the English clergy had been strengthened by that of all the women whom they could have influenced to oppose it. It would be a formidable Tory measure, and might, I think, delay educational reforms. But it seems undeniable that property ought to be represented under a system like ours, whether in the hands of women or men.

With love to Mrs. Ticknor and Anne,

Yours very affectionately,

CHARLES LYELL.

To PROFESSOR HEER.

73 Harley Street, London : June 13, 1870.

My dear Heer,—A few days ago I sent you part of Mr. President Bentham's address to the Linnæan Society, in which he disputes all determinations of Proteaceæ by fossil leaves, and says that the few imperfect specimens of fossil fruits referred to the same order of plants are not sufficient to prove their former existence in Europe. He does not say to what other order we may suppose that all these leaves, so like those of Proteaceæ, may belong. I suspect from one expression in his speech, that he thinks we ought to require more proof because the present countries of the Proteaceæ (the Cape and Australia) are so distant, and so detached from Europe. But he does not reflect that the Falunian or Upper Miocene flora must have derived its species direct or by modification from the Lower Molasse or Older Miocene (Oligocene) period, and before this time there were Eocene Proteaceæ in Europe ; and still farther back, as at Aix-la-Chapelle, there was a rich flora in the time of the White Chalk, comprehending, if I mistake not, Proteaceous genera (?)

Now the land of the Cretaceous period differed so entirely in its geographical distribution from our present continents, that the species of plants that you have called Proteaceous, to whatever family they may have belonged, are as likely to have spread from Europe to the Cape or to Australia, as to have travelled from those countries into the European area. Mr. Bentham must admit that the plants which you and other botanists have conjectured to be Proteaceous, do not belong to any of our actual European trees. They once flourished here, and when they died out they may have found an habitation elsewhere. As we are certain that they lived in Europe at the period of the White Chalk, and went on diminishing in successive tertiary periods till they became extinct in Europe, it is safer to suppose that they went from Europe to Southern Africa and Australia, than to assume that they came from those countries into our area. For if we were to adopt the latter hypothesis, we must begin by assuming that there was land in South Africa and Australia before the White Chalk was formed, of which, however probable it may be, we have no positive proof, still less that such land was inhabited by trees which had a foliage like Proteaceæ.

In conversation I told Mr. Bentham that you had often begun by determining the leaves, and years afterwards discovered the fruit, as in the case of the chestnut found in the North.

I believe that these determined botanical sceptics do harm by undervaluing paleontological evidence, and exerting themselves to bring it into contempt. If they succeed in making geologists believe that fossil plants are of little or no value, this important branch of organic remains will not be cultivated with the zeal and scientific skill to which it is entitled. I wish therefore to make as good a fight as I can in a new edition of my 'Elements,' of which we are going to print 5,000 copies or more. Any assistance you can give me will be of real use to the cause.

Believe me, my dear Heer, ever faithfully yours,

CHARLES LYELL.

To Dr. Hooker.

73 Harley Street, London: February 14, 1871.

My dear Hooker,—I got your letter at Barton, and was much pleased to hear that you had been dipping into the 'Elements,' and were pleased with it and criticising it. I was afraid of alluding to the rarity of lakes on the south side of the Himalaya, though I can quite believe that there ought to be such lakes if the ice-scooping theory were true, to the extent of accounting for such basins as the Lago Maggiore, Geneva, &c. I saw yesterday James D. Hague, a mining engineer of the United States, returned from a survey of California, who says that the American geologists have convinced themselves that the great basin between the Rocky Mountains and the Sierra Nevada, in which the Utah Salt Lake, amongst other water-bearing depressions occurs, was, in comparatively modern tertiary times, a great fresh-water lake, 500 feet deep, and of much larger dimensions than Lake Superior. If, as they suppose, this lake was formed chiefly by anticlinal and synclinal folds, connected with the structure of the adjoining mountain chains, an analogous origin may be ascribed, in great part at least, to Lake Superior and many minor lakes.

I found that Charles Bunbury had been marking in your 'Student's Flora' all the species of flowering plants growing in his park, and he was full of praise of the manner in which your work was executed after going into much of the details of it. I am reading Mivart's 'Genesis of Species,' and am only half through; it improves greatly as I proceed. I thought his first objection, that so many other Ungulata ought to have long necks as well as the giraffe, a very poor one against natural selection. But the difficulty about the eyes of the cuttle-fish, dragon-flies, and man, is very well put.

Believe me ever most truly yours,

Charles Lyell.

P.S. I am very glad of your hint about ice-shoots or avalanches. I am convinced they would explain what nothing else can, the large boulders and erratics on the lower side of the Forfarshire tarns.

To Sir Charles Bunbury.

Crown Hotel, Penrith: August 18, 1871.

My dear Bunbury,—I have been enjoying very much my tour of inspection, avoiding any regular work, and trying to make it a tour of rest, which is difficult. After being in the more central region of Buxton, I crossed the watershed of Axe Edge to the county of Cheshire above Macclesfield, where Prestwich announced that he had seen marine shells in the drift at the height of upwards of 1,200 feet. I am satisfied that the Moel Tryfaen marine fauna is found in the stratified drift not only at that height, but nearly, if not quite, at as great an elevation as at Moel Tryfaen, but the newly-discovered locality, ascending to nearly 1,400 feet inland from Macclesfield, has not been trigonometrically measured—the point is about seventy-four English miles, as the crow flies, from Moel Tryfaen. Is not this a surprising fact? implying that such a great body of land has been uplifted in post-pliocene times, for the shells, more than fifty in number, are all of recent species, and by no means like those of Moel Tryfaen; as a whole very glacial. The rarity of marine shells in intervening tracts is so puzzling. In the Lake district, though there are stratified drifts 1.200 feet high, I could not hear of a fragment of marine shells any more than in the Matlock and Buxton region. Yet if the country was now submerged 1,400 feet or more, I should think the sea would find its way to Chatsworth.

Ever affectionately yours,

Charles Lyell.

To Professor Heer.

73 Harley Street, London: March 16, 1873.

My dear Heer,—I have just seen Mr. Carruthers, who tells me that he now thinks that the cumulative evidence in favour of the existence of the order Proteaceæ in the Eocene period in Great Britain is overwhelmingly strong. Two or three years ago, when Bentham published his article denying that this could be proved by the evidence of any of the fossil leaves yet discovered, or by any of the cones in the Sheppey

Eocene clays believed by Bowerbank to be Proteaceous, Mr. Carruthers was afraid to adopt such opinions, so that I am very glad that the structure of some British tertiary wood, and a great abundance of Eocene leaves found at Bournemouth, in Hampshire, has converted him to opinions which you have long held. I was always persuaded that your opinion would turn out to be correct, but shall be glad to be able to cite the keeper of the botanical collections in the British Museum as being convinced that your views are well founded.

You kindly wish me to tell you of my health and that of Lady Lyell. As I am now half way through my seventy-fifth year, you will not be surprised to learn that my eyes, which have always been weak from boyhood, are beginning to fail me, so that I am obliged to depend on other people for writing from dictation all my letters to correspondents, and for reading all the books which I study; but I am able to walk, enjoy life and society in moderation, and if you could come to England when I am at home, I should be happy to show you hospitality. Your letters are always a great treat to me.

[My dear Mr. Heer, I am perfectly well, thank you, and should be very glad to see you again.

Very sincerely yours,[4]

MARY E. LYELL.]

Yours very faithfully,

CHARLES LYELL.

To PROFESSOR HEER.

73 Harley Street, London: July 7, 1873.

My dear Heer,—I have to thank you very much for your last two letters, which have been of extreme interest to me. Indeed, the determination which you have made of the cretaceous plants of Greenland and Spitzbergen, sent home by Professor Nordenskjold, appears to me one of the most important scientific discoveries which has been made for

[4] *Note by Mr. Heer*: 'Mad. Lyell starb an 25 April 1873; also 5 Wochen nachdem sie obigen geschrieben.'

some time. My object in writing to you now is to say that I am going to make a tour on the Continent with my sister, and hope about the second or third week in August to be in Zürich. It would give me so much pleasure to see you, if you are likely to be there, and if your health is good enough to enable you to accompany me in some short expeditions such as my own health will allow of. But if, as I fear from your last letter, you may not be equal even to so much of a geological excursion to Utznach, &c., as I hope to accomplish in company with my friend Hughes, now Professor of Geology at Cambridge, I shall still trust to my being able to obtain instructions from you respecting the position and nature of the lignite of Utznach, Dürnten, Wetzikon, &c.

I have not written to you since the sudden and unexpected death on April 24 of my dear wife, with whom you were so well acquainted, and you can, I am sure, appreciate the shock which this has given me. I endeavour by daily work at my favourite science to forget as far as possible the dreadful change which this has made in my existence. At my age of nearly seventy-six, the separation cannot be very long, but as she was twelve years younger, and youthful and vigorous for her age, I naturally never contemplated my surviving her, and could hardly believe it when the calamity happened. A feverish cold carried her off almost without pain or suffering.[5]

I should be very glad to hear from you what chance I have of finding you in Zürich or the neighbourhood.

It will be a great pleasure to see an old friend whom I knew in happier days.

Ever affectionately yours,

CHARLES LYELL.

To MISS F. P. COBBE.

73 Harley Street: July 20, 1873.

My dear Miss Cobbe,—I have been so taken up with my Geology (a new edition of the 'Student's Elements' having to be prepared), that I begin to be afraid that I shall not keep my promise of writing to you before I go abroad, if I

[5] See Appendix B.

delay any longer. Your articles on a 'Future State' in the 'Theological Review' have interested me much, but they confirm my opinion that we are so much out of our depth when we attempt to treat of this subject, that we gain little but doubt in such speculation.

I have, however, been much struck with your answer to those strange opinions thrown out by W. R. Greg in his chapter on 'Elsewhere,' which is, I think, very original and satisfactory; for when one looks back forty years, and feels compunction for many things one has done, it is wonderful what allowances one makes, because we feel that we are judging ourselves, and regard our former self with great indulgence, while at the same time it is like contemplating a different individual.

I am told that the same philosophy which is opposed to a belief in a future state, undertakes to prove that every one of our acts and thoughts are the necessary result of antecedent events and conditions, and that there can be no such thing as free-will in man. I am quite content that both doctrines should stand on the same foundation, for as I cannot help being convinced that I have the power of exerting free-will, however great a mystery the possibility of this may be, so the continuance of a spiritual life may be true, however inexplicable or incapable of proof.

But I will not weary you with more of my lucubrations, which, as I am obliged to dictate them to an amanuensis, may appear in a stiffer form than if I was able to use my own pen.

I am told by some that if any of our traditionary beliefs make us happier, and lead us to estimate humanity more highly, we ought to be careful not to endeavour to establish any scientific truths which would lessen and lower our estimate of man's place in nature; in short, we should do nothing to disturb any man's faith, if it be a delusion which increases his happiness. But I hope and believe that the discovery and propagation of every truth, and the dispelling of every error, tends to improve and better the condition of man, though the act of reforming old opinions and institutions causes so much pain and misery.

I expect to leave town for the Rhine before the end of

this week, and shall be in Switzerland in August. My sister Katharine is on her way to Innsbruck with Arthur and Rosamond.

Ever most faithfully yours,

CHARLES LYELL.

To the DUKE OF ARGYLL.

Shielhill, Kirriemuir: August 16, 1874.

My dear Duke of Argyll,—I was very glad to get your letter, and much interested in the two raised beaches of the Island of Jura. I have long been thinking that we may be under a great delusion when we find proofs of upheaval in ascribing to the movement an almost indefinite lateral extension, whereas all the evidence which we have in regard to the modern effects of earthquakes runs quite in a contrary direction.

I wish I could feel sure that you have in your library at Inverary a copy of the eleventh edition of my 'Principles of Geology,' but on second thoughts I have determined to send you by book-post the second volume, which you can return to me when you have quite done with it. I beg you will read attentively my account of the earthquake of New Zealand in 1855.

I may as well tell you that a few months before I left town a diploma was sent to me from a New Zealand Institute, given to me as the author of the most full and correct account of what happened during that great convulsion, and it was quite clear from letters then received, that the information I had given, derived from authorities peculiarly trustworthy, had been in no wise impaired by subsequent events or criticisms.

Having this event in my mind, I thought your first address to the Geological Society peculiarly telling, and I do not see how any one who is willing to interpret the former changes of the earth's surface by the light of those now going on can pretend to refer any rock basin to ice-scooping in preference to such movements as took place north and south of Cook's Straits in 1855.

Mr. Judd, whose paper on the 'Geology of the Hebrides'

occupies worthily so large a portion of the August number of the 'Quarterly Journal of the Geological Society,' has been staying here at my sister's for the last month. Coming fresh from Naples, Sicily, the Lipari, and Ponza Islands, and having seen their examples of volcanic eruptions of every kind mineralogically diversified, from the trachytic to the basaltic extreme of composition, he finds here in this county every variety of igneous rock, exhibiting exact counterparts of modern lavas, from quartz, porphyry of Volcano, one of the Lipari group, to dolerite and basalt, such as you have in Fingal's Cave and other parts of the Western Islands. The great east and west dyke which traverses this county, described by me nearly fifty years ago as containing serpentine diallage, greenstone, quartz, porphyry, dolomite hypersthene, &c., Judd has re-examined, and I am happy to say he finds nothing to alter, and what he has observed with me bearing on the section given in the 'Geological Transactions' for 1826, he also finds quite correct. He regards our numerous east and west greenstone dikes cutting through the old red sandstone, as lavas which filled up rents which passed vertically through the rocks which they traverse, and which, but for the subsequent denudation of 2,000 feet, would end in Puys like those of the carboniferous strata of Fife, or like Arthur's Seat.

Have you read in the newly issued volume of our Society's Memoirs the paper by Jamieson of Ellon, on the 'Last Stage of the Glacial in North Britain'? I think it is very suggestive, especially the intimate connection pointed out between the present excess of rainfall on the western side of Scotland as compared with that of the eastern being analogous to the excess of glaciation on the corresponding sides. It seems to show a connection between the present meteorological agencies and those of the glacial period which may help us to explain the great differences in the glacial age of the excess of snow and ice in parts of the northern hemisphere not very distant, and it may perhaps help to explain how plants and animals of tropical forms managed to escape being extinguished during the ice age. I am greatly in hopes that the north and south axes of movement, which Judd thinks he is going to establish for

the Miocene period, will explain the manner in which the valleys of Argyllshire and the west of Scotland were converted into sea lochs and fiords, so that we shall have to dispense with the hypothesis of ice action, and exchange it for that of fire.

I have a great deal more to say, and to ask you to observe, but shall wait till you have received my book.

With my compliments to the Duchess of Argyll, believe me ever truly yours,

CHARLES LYELL.

To CHARLES DARWIN, ESQ. (*dictated*).

Shielhill, Kirriemuir, Scotland: September 1, 1874.

My dear Darwin,—I have been intending from day to day to congratulate you on the Belfast meeting, on which occasion you and your theory of evolution may be fairly said to have had an ovation. Whatever criticisms may be made on Tyndall, it cannot be denied that it was a manly and fearless out-speaking of his opinions, and no one can wonder that the Belfast clergy of the Calvinistic school, three or four of them, as I suppose you saw, preached against such opinions on the Sabbath in the middle of the scientific week. It was principally, I believe, on the question of the efficacy of prayer, that objection was taken to the tone adopted by scientific writers of late, though I do not remember whether this was specially alluded to in the President's address; but Professor Jellet in one of the churches read what may be considered a regular argumentative paper on the efficacy and propriety of prayer, and I was glad to see that although part of his argument may have been special pleading, yet he fairly admitted that truth was the chief object to be kept in sight, and that unless prayer could be shown to be rational no Christian sanction and authority or Scriptural support ought to have any weight. I have been spending nine days, for the sake of change of air and sea breezes, on the coast between Arbroath and Montrose. Near the latter place I saw the Rev. H. Mitchell, who has contributed a very good paper on the Old Red Sandstone of this part of the world to our 'Quarterly Geological Journal.' He showed me his

specimens of crustacean footprints, a long series of tracks, with the mark of the body trailing along, accompanying ripple-marks, and beautiful rain-drops. This seemed to bring *Pterygotus Anglicus* vividly before one, while the entire absence of marine shells in our Devonian beds, 10,000 feet thick, seems confirmatory of their freshwater origin. Perhaps there were lakes as large as Lake Superior.

Mr. Judd (whose important paper on the 'Five Great Volcanos of the Hebrides' you will have seen), has been staying with me here, and I should have much to tell you of what I have learnt of our geology. He quite confirmed what I have published about Forfarshire.

Ever affectionately yours,

CHARLES LYELL.

To the DUKE OF ARGYLL.

Shielhill, Kirriemuir: September 14, 1874.

My dear Duke of Argyll,—The reading of Judd's paper, and his estimate of the probable height of the five great volcanic cones of the Hebrides, has left a very grand impression on my mind of those mountains, and when he has fully worked up the paleontology and shown what a rich succession of life the primary, secondary, and tertiary strata of those islands exhibit, it will make a wonderfully grand addition to British, I may say to European, geology.

With regard to your question as to whether the movement giving rise to the formation of raised beaches (like those of the Island of Jura) may not sometimes be of a *local* character, I may refer to an interesting observation of Mr. Jamieson of Ellon, to the effect that the twenty-five-foot beach of the valley of the Forth gradually diminishes in height as we pass northwards, till in Aberdeenshire it is only eight feet above the present sea-level.

In reference to what you say on the outlines of the mountains in Skye and Rum, Mr. Judd tells me that the great *intrusive* masses in the Western Isles (whether composed of granite or gabbro), frequently assume a pseudo-stratified appearance when viewed from a distance. Having read his paper since you wrote your letter to me, you will

understand what he means by gabbro, of which the Coolin Hills are constituted; and if you wish for any further explanations, he will be happy at any time to give them in reference to the geology of the Hebrides.

Mr. Judd informs me that he was acquainted with the existence, though he has not yet visited your interesting little coal-field in Kintyre. The remarkable point about the patch of coal strata in Morvern appears to him to be, that not only is it considerably to the north of any other exposure of carboniferous strata in the British Islands, but that it lies on the north-west flank of the great Grampian axis constituted by the series of granitic intrusions which extend from Peterhead on the north-east to the Ross of Mull on the south-west.

Since I sent you the representation by rubbing of a fossil from the coal in Morvern, I have heard from Sir Charles Bunbury, to whom I had sent the original specimen, that he considers it to be *Lepidodendron aculeatum*, a common coal species; he had supposed it to be a Sigillaria. The associated fossil is, as Judd thought, a Calamite, so that there can be no doubt of the geological age of the formation.

Judd quite coincides with you in your views as to the existence everywhere in the Hebrides of evidences of enormous denudation, side by side with equally striking proofs of grand subterranean movements; and like yourself, he regards the contours of the existing surfaces as the product of the continued working side by side of these two classes of forces. He was pleased to hear that you had an opportunity of seeing the remarkable outliers of tertiary basalt resting on Silurian gneiss (two of which were noticed by Macculloch, and which have their exact counterparts in the north of Ireland). Ever truly yours,

CHARLES LYELL.

To CHARLES DARWIN, ESQ.

73 Harley Street, London: September 25, 1874.

My dear Darwin,—There is no subject to which Judd oftener referred, and told me he had done so when discussing volcanic questions with Scrope, than your subsidence of St.

Jago, as being a general law of volcanic regions. The sinking down referred to by me ('Principles' vol. ii. 458, 'Student's Elements,' 149–166), as occurring in New Zealand, and which has been confirmed by the New Zealand geologists, corroborates your St. Jago experience.

Just before I left Scotland Judd made an excursion to revisit the Hebrides, and during a ten days' absence discovered for the first time carboniferous strata preserved under some two thousand feet of tertiary basalt in the Island of Mull, and he brought to me what I guessed was a Sigillaria and the cast of a Calamite; but when I sent them to Charles Bunbury he pronounced them to be *Lepidodendron aculeatum* and a Calamite, ordinary carboniferous fossils. All this is explained by admitting that in the time of the Miocene volcanos there was a sinking down like that of St. Jago in the island, near the loftiest cone of that island, and one of the five great volcanos which he believes to have existed in the Hebrides, and which may have rivalled the Peak of Teneriffe in height, in the Miocene period. How much grandeur the scenery of the Hebrides must have presented in that same Miocene period, when Madeira was already in continued action, as well as Porto Santo and the Giant's Causeway, &c.! The Duke of Argyll has sent me word that he has found a fossil *Salisburia* (now a genus growing in Japan) among the fossils of Ardtun in Mull, where he formerly found *Asa platanoides*. I wonder whether the cones of the Hebrides, if they were as high as Etna or the Peak of Teneriffe before the sinking down which you observed in St. Jago had taken place, were covered with snow in the Miocene period, when the vegetation at their base, at Ardtun for example, was sub-tropical. As there is now a vast difference in the vegetation of the desert region of Etna usually covered with snow, so in Miocene time it does not follow that volcanos ten or twelve thousand feet high should not have had on their summits a flora very different from that at their base; but these you will say are idle speculations.

It is remarkable how perfectly a sinking in Miocene times, like that which you have supposed or proved for the Cape de Verde Islands, would in Judd's opinion give a satisfactory solution to the preservation in Mull and in the cliffs

on both sides of the Sound of Mull, of those intercalations of poikilitic, triassic, liassic, oolitic, neocomian, cretaceous, and newer strata, of which a full account is to be given before the close of Judd's paper.

All the work which I have done with Judd in Forfarshire has confirmed me in the belief that the only difference between Paleozoic and recent volcanic rocks is no more than we must allow for, by the enormous time to which the products of the oldest volcanos have been subjected to chemical changes such as those which turn an olivine basalt into serpentine.

Ever affectionately yours,

CHARLES LYELL.

His death took place on February 22, 1875 (having had another family bereavement only a fortnight before, in the unexpected death of his brother Colonel Lyell, who had been almost daily with him, up to the time of his sudden and fatal illness).

Though expected by friends it was deeply felt. Dr. Hooker[6] wrote to Miss Lyell that same day:—

'I have just heard the distressing news, and can hardly yet say how much I feel it. My loved, my best friend, for well nigh forty years of my life. To me the blank is fearful, for it never will, never can be filled up. The most generous sharer of my own and my family's hopes, joys, and sorrows, whose affection for me was truly that of a father and brother combined. I deeply feel for you all; two such blows to you and your sisters, and to Mrs. Lyell, surely hardly ever came so rapidly, so remorselessly as it were.

'I have just headed a memorial to Dean Stanley, praying that he may be interred in Westminster Abbey, the Dean having volunteered his hearty assent, and every influence in his power to have it granted. Sir Edward Ryan first told me of it, and now joins with me in the earnest hope that you will allow this tribute to be paid to the most philosophical

[6] Now Sir Joseph Hooker, C.B., K.C.S.I.

and influential geologist that ever lived, and one of the very best of men.

'The memorial is being signed by Fellows of the Royal, Linnæan, and Geological Societies, and is most powerful.'

The following is the memorial in pursuance of which the body of Sir Charles Lyell was placed in Westminster Abbey:—

'We, the undersigned Fellows of the Royal, the Geological, and the Linnæan Societies, respectfully pray that the remains of Sir Charles Lyell may be interred in Westminster Abbey. For upwards of half a century he has exercised a most important influence on the progress of geological science, and for the last twenty-five years he has been the most prominent geologist in the world, equally eminent for the extent of his labours and the breadth of his philosophical views.

'Joseph Hooker, President of the Royal Society.
John Evans, President of the Geological Society.
George J. Allman, President of the Linnæan Society.
W. G. Adams, F.R.S.
J. M. Arnott, F.R.S.
George Busk, F.R.S.
H. Debus, F.R.S.
Jas. Fergusson, F.R.S.
W. H. Flower, F.R.S.
Augustus W. Franks, F.R.S.
Francis Galton, F.R.S.
J. H. Gladstone, F.R.S.
J. A. Grant, F.R.S.
W. R. Grove, F.R.S.
J. Heywood, F.R.S.
T. Archer Hirst, F.R.S.
W. Huggins, F.R.S.
T. Mck. Hughes, F.R.S.
T. H. Huxley, F.R.S.
Charles Manby, F.R.S.
J Carrick Moore, F.R.S.
E. A. Parkes, F.R.S.
John Percy, F.R.S.
Joseph Prestwich, F.R.S.
A. Ramsay, F.R.S.
H. Rawlinson, F.R.S., Pres. R.G.S.
G. Owen Rees, F.R.S.
Edward Ryan, F.R.S.
W. Sharpey, F.R.S.
W. Spottiswoode, Tres. R.S.
Warrington Smyth, F.R.S.
Thomas Thomson, F.R.S.
John Tyndall, F.R.S.
Alex. Williamson, For. Sec. R.S.
E. H. Bunbury, F.G.S.
L. L. Dillwyn, F.L.S., F.G.S.
A. Grote, F.L.S., F.G.S.
Joseph Whitworth.'

The pall-bearers were the Duke of Argyll, Sir Edward Ryan, Mr. Justice Grove, Professor Huxley, Dr. Hooker, Mr. John Evans (President of the Geological Society), Mr. J. Carrick Moore, and the Rev. W. S. Symonds.

The Dean of Westminster conducted the service.

The following Sunday the Dean of Westminster preached

the funeral sermon in the Abbey, of which the following is an extract:—

'Of him who is thus laid to rest, if of any one of our time, it may be said that he followed truth with a zeal as sanctified as ever fired the soul of a missionary, and with a humility as child-like as ever subdued the mind of a simple scholar. For discovering, confirming, rectifying his conclusions, there was no journey too distant to undertake. Never did he think of his own fame or name in comparison of the scientific results which he sought to establish. From early youth to extreme old age it was to him a solemn religious duty to be incessantly learning, constantly growing, fearlessly correcting his own mistakes, always ready to receive and reproduce from others that which he had not in himself. Science and religion for him not only were not divorced, but were one and indivisible.

'The instinct which impels us to seek for harmony between the highest truths of science and the highest truths of the Bible is an instinct far nobler and truer than that which would seek to part them asunder. In this higher instinct, he who has departed fully shared. The great religious problems of our time were never absent from his mind. The infinite possibilities of nature gave him fresh ground for his unshaken hope in the unknown, immortal future. His conviction of the peaceful, progressive combination of natural causes towards the formation of our globe filled him with a profound and ever profounder sense of "the wonder and the glory of this marvellous universe." The generous freedom allowed to religious inquiry in the National Church, the cause of humanity in the world at large, were to him as dear as though they were his own personal and peculiar concern. With that one faithful, beloved, and beautiful soul, who, till within the last two years of his life, shared all his joys and all his sorrows, all his labours and all his fame, he walked the lofty path, "which the vulture's eye hath not seen, nor the lion's whelp trodden"—the pathway of the just, "lightening ever more and more towards the perfect day," in which we humbly trust that they are now at last reunited in the presence of that light which they both so sincerely sought.'

He was buried in the nave of the Abbey. A gravestone of fossil marble from Derbyshire, selected as an appropriate tribute, bears the following inscription :—

CHARLES LYELL
BARONET F.R.S.

AUTHOR OF
'THE PRINCIPLES OF GEOLOGY'
BORN AT KINNORDY IN FORFARSHIRE
NOVEMBER 14 1797
DIED IN LONDON
FEBRUARY 22 1875

THROUGHOUT A LONG AND LABORIOUS LIFE
HE SOUGHT THE MEANS OF DECIPHERING
THE FRAGMENTARY RECORDS
OF THE EARTH'S HISTORY
IN THE PATIENT INVESTIGATION
OF THE PRESENT ORDER OF NATURE
ENLARGING THE BOUNDARIES OF KNOWLEDGE
AND LEAVING ON SCIENTIFIC THOUGHT
AN ENDURING INFLUENCE
'O LORD HOW GREAT ARE THY WORKS
AND THY THOUGHTS ARE VERY DEEP'
PSALM XCII. 5.

A marble bust by Mr. Theed, after the original one by Gibson, is placed near the grave.

A few words from one[7] who had frequent opportunities of seeing him in his latter years may be appropriate here, as they are full of comprehension of the child-like simplicity, and the vigour of intellect combined with a deep earnestness, which were his chief characteristics :—

'The last of the elder generation of our great men of science, Sir Charles Lyell, leaves behind him the memory of a character almost ideally representing what such men should be; so free from egotism, vanity, or jealousy, so ready to be pleased with every innocent jest or amusement, so ready to listen patiently to the remarks of those infinitely below his intellectual calibre, and withal so affectionate and tender of heart, that no child could be more simple; and, on the other hand, so filled with reverent enthusiasm for the glory and grandeur of the universe to whose study

[7] Miss F. P. Cobbe.

he devoted himself, and so ready to open his mind to each new truth, that no man could better deserve the high title of a true philosopher. Nor did his philosophy, though it released him from some of the bonds of early prejudice, ever lead him to renounce those highest truths to which the lesser ones of science lead up. It was his frequent observation that religious sentiment deserved as much confidence as any other faculty of our nature, and in full faith and hope in God and immortality he passed calmly into the dark valley of age and death.' [8]

[8] See Appendix C.

APPENDICES.

APPENDIX A.

Vol. I. p. 376.

From Captain Basil Hall, R.N., *to* Leonard Horner, Esq.

Geneva: September 7, 1833.

My dear Sir,—Upon the whole I am glad that our admirable friend Lyell has disentangled himself from King's College and the Royal Institution. He will do more for his science, and for himself, and for us who love both, by observing and writing, than he could by possibility do by lecturing alone. Could he do both, it would be better certainly, but if the lectures are to interfere with his publications, and still more with his observations, and his journeys to see men as well as rocks, it is clearly the wisest plan to cut the cockneys, and address himself solely to men of science, or to those who, without that pretension, are capable of understanding his most excellent writings.

I think his book by many many degrees the best work, not only on his subject, but on any scientific subject with which I am acquainted. It reduces an intricate, obscure, and most enormously copious subject, to one which is almost mathematically arranged, clear and condensed. His generalisations are quite inimitable, except by the singular beauty and force of his detailed descriptions and his patient investigation of disputed points; to which I may add the calm, dispassionate, gentlemanlike style in which he handles, not one, but every controversial subject which the subject requires should be discussed. And yet he does this with so

much liveliness both of manner and of diction, and with such genuine earnestness, that I, for one, cannot help being swept away with the gentle but irresistible current of his persuasive eloquence. For, indeed, his book contains the essence of eloquence; right reason, extensive and exact knowledge, cultivated taste, and a disinterested and philosophical desire to state the matter in such a way that truth may be the result. There is, moreover, an elegance of fancy throughout, and a touch of humour, or rather of wit, which are in happy companionship with the simplicity and general elegance of the composition. It is already, in my apprehension, the first book of the day, and every time I read it, I am filled the more and more with respect for the author's talents and his knowledge, and feel more and more grateful to him for the pleasure he has given me. I trust he will be able soon to print a cheaper edition, for the book would soon be very extensively circulated, if its form and price were such as to enable the great body of readers to get at it.

It is the most abominable shame in the world Lyell's book not being translated into French. Their science is very much a matter of talk and pretension, and in geology they believe that beyond their eternal Paris Basin, there is nothing worth looking at or thinking about. Did you see in one of the five hundred Eloges on Cuvier, what a Paris *savant* said of him. 'It would almost appear,' said the modest eulogiser, 'as if the Almighty had placed this vast and wonderful collection of fossil remains for the express purpose of being discovered and descanted upon by our great countryman!' Poor Cuvier! how little did this ass know of the taste of the mighty man about whom he was braying, to an audience, who if they had possessed a grain more sense than the orator, ought to have made a 'fossil remain' of him forthwith, by pitching him over the quay into the silt of the Seine.

Ever most truly yours,

Basil Hall.

APPENDIX B.

VOL. II. p. 451.

[The following Tribute to the Memory of Lady Lyell by George S. Hillard, Esq., is so just and true, that it is placed here in order that she, who was the constant and cherished companion of her husband for forty years, might be united with him in these volumes.]

From the Boston (United States) 'Daily Advertiser,' May 19, 1873.

'DIED IN LONDON, AFTER A SHORT ILLNESS, APRIL 24, MARY ELIZABETH, WIFE OF THE CELEBRATED GEOLOGIST, SIR CHARLES LYELL.

'There are many hearts in the United States that will be saddened by the death of this admirable woman. She had twice visited our country in company with her husband, and in every part of it had made warm and lasting friends. And such she could not but make, for she had a rare union of the qualities which ensure confidence with those that win affection. Strength and sweetness were hers, both in no common measure. The daughter of Leonard Horner, and the niece of Francis Horner, in her an excellent understanding had been carefully trained, and she had that general knowledge and those intellectual tastes which we expect to find in an educated Englishwoman: and from her childhood she had breathed the refining air of taste, knowledge, and goodness. Her marriage with an eminent man of science gave a scientific turn to her thoughts and studies, and she became to her husband not merely the truest of friends and the most affectionate and sympathising of companions, but a very efficient helper. She was frank, generous, and true; her moral instincts were high and pure; she was faithful and

firm in friendship; she was fearless in the expression of opinion, without being aggressive; and she had that force of character and quiet energy of temperament that gave her the power to do all that she had resolved to do.

'All that we have said she might have been, and yet not have been winning and sweet; but this she was, and to such an extent that those who saw her only casually, carried away hardly any other impression of her. She had more than a common share of personal beauty; but had she not been beautiful she would have been lovely, such was the charm of her manners, which were the natural expression of warmth and tenderness of heart, of quick sympathies, and of a tact as delicate as a blind man's touch. This woman, so widely informed, so true, so strong, so brave, seemed all compact of softness, sweetness, and gentleness; a very flower that had done no more than drink the sunshine and the dew. In her smile, her greeting, the tones of her voice, there was a charm which cannot be described, but which all who knew her have felt and will recall.

'No tribute to Lady Lyell would be complete that did not speak of her strong attachment to America and American friends. Her feelings in this direction were in harmony with her warmth of heart and her generous spirit. She was a fervid and enthusiastic friend to America. During the war there was not a woman or a man in England that stood by the Union and the Government more ardently and fearlessly than she. Never, at any period, was she silent when America was disparaged. No one has died in England upon whose monument might be more appropriately carved the words, "Here lies the friend of America."

'We have dwelt somewhat upon Lady Lyell's strong attachment to America, not merely because it entitles her to the grateful remembrance of all Americans, but because it was illustrative of her independence of judgment and her generous and catholic nature. For be it remembered that she was an Englishwoman, and never for a moment could have been taken for anything but an Englishwoman; but she came to America with no insular prejudices and no conventional standard. She did not look at this great country with the eye of a lady in waiting. In her view, usages and

customs were not wrong simply because they were not English. She saw and appreciated all that was good in us; and if she saw anything that she could not approve, she was willing to forget it.

'Lady Lyell had reached an age when the end of life begins to be a natural event, and cannot be called premature; but such was her warmth of heart, so fresh were her feelings, her faculties so bright, that her death falls upon the hearts that loved her with the shock of unexpectedness, and in parting from her, her friends must feel that to them something of the light of life has passed away from earth.'

APPENDIX C.

Vol. II. p. 463.

[The following Tributes, written after the death of Sir Charles Lyell, are extracts from some of the many notices which appeared in various journals, and are offered as being eminently characteristic of him, and his work.]

'To sketch the life and labours of Sir Charles Lyell would be much the same thing as sketching the development of the modern school of British geology during well-nigh half a century. The task to which he devoted his noblest energies was that of establishing the principles of geology on a sound and philosophical basis. His leading lesson was a belief in the uniformity of the laws of nature: a belief which led him to argue that by studying the changes which are being wrought upon the surface of the earth by the silent action of forces now in operation, we put ourselves in possession of a key to the interpretation of those ancient records which it is the special business of the geologist to decipher. Sir Charles, indeed, developed with singular success the great truths which were first enunciated by Dr. Hutton of Edinburgh, and eloquently illustrated by his friend Professor Playfair. Hutton died in 1797, and it is curious to note that the same year which witnessed his death gave birth to one who was destined to expound his doctrines with such force of argument as to carry them successfully against all opposition, and establish them as fundamental principles of the science.

'The earliest scientific observations of the young geologist appear to have been made on the rocks of his native country, since we find that his first paper, contributed in 1825 to the "Edinburgh Journal of Science," was one on a dike of serpentine in the county of Forfar. The first volume of his celebrated "Principles of Geology" was published in 1830.

So great has been the popularity of this work, that it has passed through no fewer than eleven editions; and during his last illness, the venerable author was engaged upon a twelfth.

'In casting a glance over the life of Sir Charles Lyell, it will be seen that he was characterised by singular steadiness of purpose. The great doctrine of uniformitarianism which he advocated in 1830, he nobly supported to the day of his death, although modified, of course, by the progress of scientific inquiry. He made everything subordinate to his one ruling idea, that of establishing the principles of geology upon a thoroughly logical basis. Nor were his honesty and boldness less marked than his steadiness and concentration. A staunch advocate of perfect freedom of scientific opinion, he fearlessly pushed his principles to their legitimate conclusions. Having first satisfied himself of the soundness of his fundamental postulates, and employing a vigorous logic at each successive step of his reasoning, he cared but little whither his conclusions carried him; whether they chanced to fall in unison with general belief, or cut directly across the grain of popular prejudice. Toleration had been taught him by bitter experience in early life. Like most advanced thinkers he had suffered keenly from the harsh criticisms of the narrow-minded; he had shared the fate which usually falls to

> Teachers whose minds move faster than the age,
> And faster than society's slow flight.

'Perhaps the most striking characteristic of Sir Charles Lyell, was his remarkable mental plasticity—a power which made him ever ready to receive new impressions, and never too proud to correct his old views, or confess to a change in his previous opinions. Not that he craved for novelty merely for novelty's sake. But if he considered that fresh evidence on a given subject justified the alteration of a previously formed opinion, he frankly turned round and renounced his old views. This was nowhere more strikingly seen than in his change of attitude towards the great question of the Origin of Species after the publication of Mr. Darwin's epoch-marking work. Whenever Sir Charles considered that a case had been fairly made out, he was too

noble to shut his eyes against the evidence, but freely accepted the new conclusion, even to the overthrow of his previous work. It was the advancement of the philosophy of geology, not the advancement of self, that he was constantly seeking. To the very last he retained this plasticity of mind; a characteristic which led him so freely, yet so cautiously, to bend before new arguments, and to stretch his old views to meet the requirements of modern research; thus strikingly unlike so many men of genius, who having developed in early life to a certain point, are content to spend the rest of their life in a state of intellectual crystallisation.'[1]

'The first generation of geologists has passed away. Buckland, Conybeare, Sedgwick, Murchison, Phillips, all—with the exception of the first two—have died within the last few years; and now Sir Charles Lyell, full of years and honours, has been added to the number.

'Knowledge has widened all round; larger views of nature and the universe have gained credit everywhere; and geology has fully shared in the general expansion. In this process no one has had a greater share than Sir Charles Lyell. For he was much more than a mere geologist. He had a well-trained and philosophic mind, which enabled him to take large views of every subject presented to his intellect, to see its various bearings and its points of alliance or contrast with other ranges of thought. All his work was done leisurely, fully, and completely, in large books, and not in fragments of essays and papers; and every book was absolutely finished up to the point which knowledge had reached when he put it forth. Sir Charles Lyell, in spite of his great age, has been singularly open to fresh accessions of knowledge and fresh generalisations from the increasing store of facts; and it is no light testimony to the original soundness of his views, that they have easily admitted an assimilation of all fresh discoveries and a re-adjustment to newly-accepted theories. A striking example of this was given in his late conversion to Mr. Darwin's doctrine of Natural Selection. Nine editions of the "Principles of

[1] By F. W. Rudler in the *Academy*, February 27, 1875.

Geology" had carried his name and reputation over the civilised world, and along with it his exposition of the doctrine of Special Creations. The only explanation which then seemed possible to him of the perpetual change of life revealed by successive strata was, that when the material conditions of any district became so changed that the old inhabitants died out, a new creative *fiat* went forth, by virtue of which the district was again peopled with fresh inhabitants especially adapted to its new conditions. When, however, it was shown that causes were at work which slowly and gradually modified the characters of plants and animals, so that they became adjusted by a self-adapting process to the changing circumstances around them, he gladly adopted a view which was so much in harmony with his general principles; and he put forth a tenth edition, in which the old theory was formally renounced, and the new one taken up. It was justly characterised by Dr. Hooker, in his address to the British Association at Norwich, as a bright example of heroism, that an author could thus abandon, "late in life, a theory which he had for forty years regarded as one of the foundation-stones of a work that had given him the highest position attainable among contemporary scientific writers;" and it was no less justly observed that the superstructure must be very solid and coherent which could allow the builder thus "to undermine it and substitute a new foundation," and yet, after all, survey his edifice, and behold it, "not only more secure, but more harmonious in its proportions than it was before."'[2]

'Lyell was not only a keen investigator of natural phenomena, he was also a shrewd observer of human nature, and his four interesting volumes of travel in America are full of clever criticism and sagacious forecasts. His mind, always fresh and open to new impressions, by sympathy drew towards it and quickened the enthusiasm of all who studied nature. Had he done nothing himself, he would have helped science on by the warmth with which he hailed each new discovery. How many a young geologist has been braced up for new efforts by the encouraging words he heard

[2] From the *Guardian*, March 3, 1875.

from Sir Charles, and how many a one has felt exaggeration checked, and the faculty of seeing things as they are strengthened, by a conversation with that keen sifter of the true from the false!

'The little wayside flower, and from early associations still more the passing butterfly, for the moment seemed to engross his every thought. But the grandeur of the sea impressed him most; he never tired of wandering along the shore, now speaking of the great problems of earth's history, now of the little weed the wave left at his feet. His mind was like the lens that gathers the great sun into a speck, and also magnifies the little grain we could not see before. He loved all nature, great and small.

'In the companion of his life, sharing his labour, thinking his success her own, Sir Charles had an accomplished linguist who braved with him the dangers and difficulties of travel, no matter how rough; the ever-ready prompter when memory failed, the constant adviser in all cases of difficulty. Had she not been part of him she would herself have been better known to fame. The word of encouragement that he wished to give lost none of its warmth when conveyed by her; the welcome to fellow-workers of foreign lands had a grace added when offered through her. She was taken from him when the long shadows began to cross his path; but it was not then he needed her most. When in the vigour of unimpaired strength he struggled amongst the foremost in the fight for truth, then she stood by and handed him his spear or threw forward his shield. He had not her hand to smooth his pillow at the last, but the loving wife was spared the pain of seeing him die.

'His was a well-balanced, judicial mind which weighed carefully all brought before it. A large type of intellect—too rare not to be missed. But it was well that circumstances did not combine to keep the young laird on his paternal lands among the hills of Forfarshire: it was well for science that he was induced to prefer the quieter study of nature to the subtle bandying of words or the excitement of forensic life. Failing health had for some time removed him from debates. Still, to the last his interest in all that was going on in the scientific world never failed, and nothing

pleased him more than an account of the last discussion at the Geological Society, or of any new work done.'[3]

At a meeting of the Edinburgh Geological Society, March 4, 1875, the President, Mr. D. Milne Home, said

'That since their last meeting they had met with a severe loss by the death of the distinguished man who held in their Society the honorary office of patron. Sir Charles Lyell's death he was sure all of them deeply regretted, not merely as geologists but as Scotchmen. He was the oldest of a very distinguished band, who, during the last fifty years, had done more for geology than had been effected in any other country. In fact, the very foundations of the science were, it might be said, laid in the city of Edinburgh by Sir James Hall, Hutton, Playfair, and Jamieson. Many others, animated by their example and stirred by the novelty of their investigations, came forward to help in carrying on this good work.

'But of all the labourers in the geological field who had done good service, he ventured to say that no one of them, nor even all of them together, had done so much to extend the geological edifice and raise it to its present conspicuous height, as Sir Charles Lyell. How could it be otherwise? His whole life after manhood was devoted to geology. He probably collected more facts and drew more important conclusions than had ever been done by any other geologist. His published works formed a treasury of valuable information, and his method of investigation gave important lessons which all labourers in the same field would do well to profit by.

'In working out his speculations, Sir Charles Lyell always endeavoured to obtain a broad basis on which to rest them. He pointed out the absurdity of drawing conclusions applicable to the whole earth from phenomena observable only in one country. To attain that object he himself travelled, hammer in hand, over half the earth's surface. In search of facts he visited more than once almost every country in Europe; and was twice in North America and Canada.

[3] From *Nature*, March 4, 1875. By Prof. Hughes.

'The great ends he accomplished were due to methodical industry, to delight in making a discovery, to love of truth, and to untiring perseverance. These were the simple weapons with which he fought the battle of life, and by means of which he amassed for the benefit of his race a rich store of truths previously unknown, and laid up for himself a reputation which would long endure. He had mentioned the love of truth as one of the motives by which Lyell was inspired. That feeling was in him so strong and sacred that whenever he discovered he was in error, whether error of fact or of inference, he never was happy till he had an opportunity of publicly avowing and correcting it.

'Sir Charles Lyell visited Scotland last year, and went to his paternal estate of Kinnordy, in Forfarshire, in the neighbourhood of the Sidlaw Hills and the more lofty Grampian range, with which, as a boy, he had been familiar. He there took the opportunity of revisiting some of the haunts of his earlier days, and the spots where the love of his favourite science had first been imbibed, and had the satisfaction of feeling that all through his life he had been faithful to his first love, and under its impulse had done service to the world, and also done credit to the land of his birth.'[4]

[4] From the *Scotsman*, March 5, 1875.

APPENDIX D.

Bequest to the Geological Society.

Extract from, and Codicil to, the Will of the late Sir Charles Lyell, Bart.

I give to the Geological Society of London the die executed by Mr. Leonard Wyon of a medal to be cast in bronze and to be given annually and called the Lyell Medal, and to be regarded as a mark of honorary distinction and as an expression on the part of the governing body of the Society, that the medallist (who may be of any country or either sex) has deserved well of the science. I further give to the said Society the sum of two thousand pounds (free of legacy duty) to be paid to the President and Treasurer for the time being, whose receipt shall be a good discharge to my Executors; and I direct the said sum to be invested in the name of the said Society or of the Trustees thereof in such securities as the Council shall from time to time think proper, and that the annual interest arising therefrom shall be appropriated and applied in the following manner:—Not less than one third of the annual interest to accompany the medal, the remaining interest to be given in one or more portions at the discretion of the Council for the encouragement of geology or of any of the allied sciences by which they shall consider geology to have been most materially advanced, either for travelling expenses or for a memoir or paper published or in progress, and without reference to the sex or nationality of the author or the language in which any such memoir or paper shall be written.

And I declare that the Council of the said Society shall be the sole judges of the merits of the memoirs or papers for

which they may vote the Medal and Fund from time to time.

And I direct that the legacy hereinbefore given to the said Society, shall be paid out of such part of my personal estate as may be legally applicable to the payment of such bequests.

As a Codicil to my Will dated January 1874, in which I directed that the Medal should be awarded annually by the Council of the Geological Society, I think it would be preferable that, instead of requiring it and the interest of the 2,000*l.* to be given annually, I should leave it to the discretion of the Council to suspend the awarding of the Medal for one year, as it may sometimes be a source of embarrassment when there are several medals to bestow, to be forced to find a fit recipient. In this case the Council would have in the year following a larger sum from the interest of the 2,000*l.*, as well as two medals, to give away—which might be an advantage, because it has sometimes happened that two persons have been jointly engaged in the same exploration in the same country, or perhaps on allied subjects in different countries, and the Council may think that the labours of both of them may deserve to be crowned by a mark of their approbation. In this case a medal may be given to each, with such proportion of the interest as the Council may decide, always not being less to each medal than one third of the annual interest of the 2,000*l.* as directed in my Will.

APPENDIX E.

Geological Papers and Works by Sir Charles Lyell.

'On a recent Formation of Freshwater Limestone in Forfarshire, and on some recent Deposits of Freshwater Marl,' *Geological Society's Transactions*, 1825.

'On Serpentine Dyke in Forfarshire,' *Edinburgh Journal of Science*, 1825.

'On various Scientific Institutions in England,' *Quarterly Review*, 1825.

'On Fossil Bones of the Elephant and other Animals found near Salisbury,' *Geological Society's Proceedings*, 1826.

'On the Strata of the Plastic Clay Formation between Christchurch, Hants, and Studland Bay, Dorset,' *Geological Society's Transactions*, 1826.

'On the Freshwater Strata of Hordwell Cliff, Beacon Cliff, and Barton Cliff, Hampshire,' *Geological Society's Transactions*, 1826.

Review of Scrope's 'Geology of Central France,' *Quarterly Review*, 1827.

'Lyell and Murchison on Excavation of Valleys,' *Edinburgh New Philosophical Journal*, 1829.

'Lyell and Murchison on Lacustrine Deposits of Cantal,' *Annales des Sciences Naturelles*, 1829.

'Murchison and Lyell on Freshwater Formation of Aix in Provence,' *Edinburgh Philosophical Journal*, 1829.

'Principles of Geology,' vol. i. 8vo. January, 1830.
" " " " ii. " " 1832.
" " " " i. 2nd edition, 8vo. " 1832.
" " " " ii. " " 1833.
" " " " iii. 1st edition, 8vo. May 1833.
" " " New edition (called the third) of the whole work, in four vols. 12mo. May 1834.

'On Freshwater Formation of Cerdagne in the Pyrenees,' *Magazine of Natural History*, 1834.

'On the Proofs of a gradual Rising of the Land in certain Parts of Sweden, The Bakerian Lecture,' *Philosophical Transactions*, 1834.

'On the Change of Level of the Land and Sea in Scandinavia,' *British Association Report*, 1834.

'Principles of Geology,' 4th edition, four vols. 12mo. June 1835.

'On Relative Ages of Crag in Norfolk and Suffolk,' *Magazine of Natural History*, 1835.

'On the Cretaceous and Tertiary Strata of the Danish Islands of Seeland and Möen,' 1835.

'On the Occurrence of Fossil Vertebræ of Fish of the Shark Family in Loess of the Rhine,' *Geological Proceedings*, 1835.

'Address as President of the Geological Society,' 1836.

" " " " 1837.

'Principles of Geology,' 5th edition, in four vols. 12mo., March 1837.

'On Phenomena connected with the Junction of Granitic and Transition Rocks near Christiania in Norway,' *British Association Report*, 1837.

'On Vertical Lines of Flint, traversing Horizontal Strata of Chalk near Norwich,' *British Association Report*, 1838.

'Elements of Geology,' 1st edition, in one vol., July 1838.

'On the Occurrence of Graptolites in the Slate of Galloway,' *Geological Proceedings*, 1838.

'Remarks on Captain Bayfield's Canada Shells,' *Geological Transactions*, 1839.

'On Remains of Mammalia in the Crag and London Clay of Suffolk,' *British Association Report*, 1839.

'On Sandpipes in Chalk near Norwich,' *Philosophical Magazine*, 1839.

'On Fossil Teeth of Leopard, Bear, &c. at Newbourn, Suffolk,' *Annals of Natural History*, 1839.

'On Fossil Quadrumana, Marsupials, &c., in London Clay, near Woodbridge, Suffolk,' *Annals of Natural History IV.*, 1839.

'Principles of Geology,' 6th edition, three vols. 12mo., June 1840.

'On Ancient Sea-cliffs in the Valley of the Seine in Normandy,' *British Association Report*, 1840.

'On the Boulder Formation and Mud Cliffs of Eastern Norfolk,' *Geological Magazine*, 1840.

'On the Geological Evidence of the former Existence of Glaciers in Forfarshire,' *Geological Proceedings*, 1840.

'On the Genus Conus in the Lias of Normandy,' *Annals of Natural History VI.*, 1840.

'On the Faluns of the Loire,' *Geological Society's Proceedings*, 1841.

'On the Freshwater Fossil Fishes of Mundesley as determined by Agassiz,' *Geological Society's Proceedings*, 1841.

'Remarks on the Silurian Strata between Aymestry and Wenlock,' *Geological Society's Proceedings*, 1841.

'Notes on the Silurian Strata near Christiania in Norway,' *Geological Proceedings*, 1841.

'Elements of Geology,' 2nd edition, in two vols. 12mo., June 1841.

'On the Carboniferous and Older Rocks of Pennsylvania,' 1841.

'On the Recession of the Falls of Niagara,' *Geological Society's Proceedings*, 1842.

'On the Elevated Beaches and Boulder Formations of the Canadian Lakes and Valley of St. Lawrence,' *Geological Society's Proceedings*, 1842.

'On Fossil Foot-prints of Birds, Connecticut,' *Geological Society's Proceedings*, 1842.

'On the Tertiary Formations in Virginia,' *Geological Society's Proceedings*, 1842.

'On Tertiary Strata of Martha's Vineyard,' *Geological Society's Proceedings*, 1843.

'On Mastodon at Big-bone-Lick, Kentucky,' *Geological Society's Proceedings*, 1843.

'On Coal and Gypsum of Nova Scotia,' *Geological Society's Proceedings*, 1843.

'On Loess of the Rhine,' *Edinburgh Philosophical Journal*, 1843.

'On Chalk of New Jersey,' *Geological Journal*, 1844.

'On Age of Plumbago and Anthracite at Worcester, Massachusetts,' 1844.

'Report on Haswell Colliery, Lyell and Faraday,' *Geological Journal*, 1844.

'On Miocene Strata of Maryland, Virginia,' &c., *Geological Journal*, 1845.

'On White Limestone, and Eocene Formations of Virginia, Carolina, &c.,' *Geological Journal*, 1845.

'On Lava-currents, Auvergne,' *Geological Journal*, 1845.

'Travels in North America,' with Geological Observations, two vols., 1845.

'On Coal-Field of Tuscaloosa, Alabama,' *Silliman's Journal*, 1846.

'On Alabama Coal-fields,' *Geological Journal*, 1846.

'On Newer Deposits of Southern States, Claiborne,' *Geological Journal*, 1846.

'On Fossil Foot-prints, allied to Cheirotherium, in Pennsylvania,' *Geological Journal*, 1846.

'On Delta of Mississippi,' *Lecture to the British Association*, 1846.

'Principles of Geology,' 7th edition, in one vol. 8vo., February 1847.

'Age of Volcanos in Auvergne, as determined by Fossil Mammalia,' *Lecture at Royal Institution*, 1847.

'On Structure and Probable Age of Coal-field of James River, Virginia,' *Geological Society*, 1847.

'On Craters of Denudation, with Observations on the Structure and Growth of Volcanic Cones,' *Geological Society's Proceedings*, 1849.

'On Recent Foot-prints on Red Mud in Nova Scotia,' *Geological Journal*, 1849.

'A Second Visit to the United States of North America,' two vols., 1849.

'Lecture on Delta of Mississippi at the Royal Institution,' 1849.

'Principles of Geology,' 8th edition, in one vol. 8vo., May 1850.

'On Forests of Erect Fossil Trees in Coal Strata of North America,' *Lecture at Royal Institution*, 1850.

'President's Address to Geological Society of London,' 1850.

" " " " " 1851.

'Elements of Geology,' 3rd edition (or Manual of Elementary Geology), in one vol. 8vo., January 1851.

'On Impressions of Rain-drops in Ancient and Modern Strata,' *Lecture at Royal Institution*, 1851.

'On Fossil Rain-marks of the Recent Triassic and Carboniferous Periods,' *Geological Quarterly Journal*, 1851.

'On Blackheath Pebble-bed, and on Certain Phenomena in the Geology of the Neighbourhood of London,' *Royal Institution's Proceedings*, 1851.

'Elements of Geology,' 4th edition (or Manual), in one vol. 8vo., January 1852.

'On Tertiary Strata of Belgium and French Flanders,' *Geological Journal*, 1852.

'Principles of Geology,' 9th edition, in one vol. 8vo., June 1853.

'On Remains of Dendrerpeton and Land Shells in Nova Scotia, by Sir C. Lyell and J. W. Dawson, with Notes by Wyman,' *Quarterly Geological Journal*, 1853.

'On Geology of Madeira,' *Quarterly Geological Journal*, 1853.

'Elements of Geology,' one vol. 8vo., February 1855.

'On Erratic Blocks West of Massachusetts,' *Royal Institution Lecture*, 1855.

'On Successive Changes in Temple of Serapis,' *Royal Institution Lecture*, 1856.

'On Stony Lava on Steep Slopes on Etna,' *Royal Society's Proceedings*, 1858.

'On Consolidation of Lava and on Volcanos,' *Royal Institution Lecture*, 1859.

'Antiquity of Man,' in one vol. 8vo., 1st edition, February 1863.
" " " 2nd " April 1863.
" " " 3rd " November 1863.

'Elements of Geology,' 6th edition, in one vol. 8vo., January 1865.

'Principles of Geology,' 10th edition, in two vols. 8vo., the first in November 1866, the second in 1868.

'Student's Elements of Geology,' one vol. 12mo., 1871.

'Principles of Geology,' 11th edition, in two vols. 8vo., January 1872.

'Antiquity of Man,' 4th edition, one vol. 8vo., January 1873.

INDEX.

AAR

AAR-FALL, i. 86
Aberfeldy, i. 48
Academy dinner, ii. 375
Ægean Sea, i. 27
Agassiz, Louis, i. 457; ii. 104, 128, 154, 159, 169, 184, 401
Airlie, Lord, i. 48, 130, 345
Lady, i. 124, 135
Aletsch Lake, ii. 403
Allen, John, ii. 7
Alpbach, i. 85
American politics, ii. 54, 57, 63, 67, 85, 96
Ammonites Bucklandi, i. 40
Anning, Mary, i. 153, 247, 250
'Antiquity of Man,' ii. 341
Apennines, crossing the, i. 109
Arago, i. 128
Ardtornish, i. 52
Argyll, Duke of, letters to, ii. 346, 431, 453, 456
Arno, fossils from Val d', i. 206
Arnold, Dr. Joseph, i. 41, 42, 43, 44, 53, 55
Arpenaz, Cascade d', i. 68
Arveiron, river, i. 74, 75
Athenæum Club, i. 263
Auvergne geology, i. 185, 201, 238
Ava fossils, i. 176
Awe, Loch, i. 49

BABBAGE, CHARLES, i. 178, 361, 364, 385; ii. 11, 13, 30, 88; letters to, i. 387, 395, 403; ii. 9, 53, 89
Bäcke-hästen, i. 421
Bagnères de Luchon, i. 291
Balmoral, ii. 156
Barcelona, i. 280
Barino, Alexander, i. 9, 54
Barrande, ii. 222–225
Bartley Lodge, Hants, i. 2, 3, 7, 10

BUN

Basle, i. 77
Bayley, Dr., i. 18, 25, 26, 27, 29, 30
Beaumont, Elie de, i. 272, 273, 274, 347; ii. 3, 4, 43, 243
Beaumont, Gustave de, ii. 150
Beek, Dr., ii. 13, 16, 22
Bell, Sir Charles, i. 346
Bentham, George, ii. 447, 450
Berne, i. 89
Berzelius, i. 427, 452
Bezzi, Signor, ii. 286
Bibliothèque du Roi, i. 62
Bologna, i. 108
Bonaly Tower, ii. 25
Bonn, i. 319, 389, 398, 456
Boott, Dr. Francis, ii. 212
Borromean Isles, i. 99
Botany, ii. 55, 99, 162, 199, 216, 231, 313, 415
Botany, fossil, ii. 93, 145, 192, 210, 241, 246, 409
Boué, i. 321; ii. 229
Bowstead, Dr., i. 405
Brera Gallery, i. 99
Brieg, i. 98
British Association, ii. 23, 42, 45, 50, 54, 76, 129
British Critic Review, ii. 4
Broderip, William, i. 169, 357
Broglie, Duchesse de, i. 146
Brongniart, Alexander, i. 124, 130, 150
Brooke, Rajah, ii. 279
Brougham, Lord, i. 170; ii. 24
Brown, Robert, i. 313, 218; ii. 145, 284
Brewster, Sir David, ii. 13
Buckland, Rev. Dr., i. 32, 43, 44, 53, 115, 120, 155, 157, 161, 164, 177, 276, 388
Buckle's 'History of Civilisation,' ii. 279
Bullock's Museum, i. 40
Bunbury, Sir Charles, letters to, ii. 88, 92, 132, 137, 145, 146, 158, 165, 173,

BUN

198, 205, 208, 211, 230, 238, 284, 334, 338, 344, 349, 377, 402, 409, 414, 439, 441, 449
Bunbury, Lady, letters to, ii. 196, 313, 322, 358, 427
Bunsen, Chevalier, ii. 139, 167, 341
Bunsen, Professor, ii. 244
Busk, George, ii. 199
Byron, Lord, i. 105

CALDONA coal-basin, i. 202
Calais, i. 57
Cambridge, i. 167
Campagna of Rome, ii. 275
Cantal, fossils of, i. 191
Carnac in Normandy, i. 276
Carnot, i. 130
Carruthers, ii. 449
Cartoons of Raffael, ii. 175
Casa Inglese, Etna, ii. 305
Castlereagh, Lord, i. 136
Catalonia, excursion into, i. 279, 283
Catalpa, i. 99
Catania, i. 219, 221
Canraine, i. 241, 245
Cave, Yorkshire, i. 120
Chalmers, Dr., i. 331
Chamouni, i. 67, 70, 75
Chantrey, Sir Francis, i. 161, 166, 353, 367
Château of Clarens, i. 90
Cheirotherium, ii. 102
Chess, i. 28, 44
Chillon, Castle of, i. 90
'Christabel,' i. 36
Christian, Prince, i. 412, 416; ii. 16
Clark, Sir James, ii. 157, 369, 371
Classicus paper, i. 21, 22, 26, 29
Clarendon, Lord, ii. 117, 119
Clathrarium Lyelli, i. 161, 177
Cobbe, Miss F. P., letter to, ii. 451
Cockburn, Lord, i. 332, 335, 363
Cole, Lord, letters to, i. 453
Colenso, Bishop, ii. 359, 360
Coleridge, i. 37, 163
Conchology, i. 311
Conde d'Espagne, i. 280, 285
Conybeare, Rev. W. D., i. 151, 252, 253, 256, 259, 310
Cooke, Captain, i. 268, 275, 300, 301
Copley, Lord Lyndhurst, i. 167
Coral Islands, theory of, ii. 12
Cortachie, i. 48
Costa, Professor, i. 213
Couverele, i. 73
Cowdray Castle, i. 18
Crawford, John, i. 176
Croft, Sir John, i. 126, 134

FAR

Croll, ii. 407
Cuming, collector of shells, i. 348
Curtis, John, i. 16, 162, 171, 179; ii. 206
Cuvier, i. 62, 125, 126, 127, 128, 133, 134, 136, 249, 300, 307

DANIEL, Professor, i. 403
Dante, ii. 135
Darwin Charles. Letters to, i. 474; ii. 20, 43, 325, 358, 362, 364, 383, 384, 408, 415, 441, 455, 457
D'Aubuisson, i. 275, 276
Davies, Rev. R. S., i. 3, 4, 9,
Davy, Sir Humphry, i. 46, 47
Davy, Lady, i. 180
Dawson, Principal, ii. 180; letters to, 185, 280, 332, 338, 425, 428
Debey, Dr., ii. 240
De Candolle, i. 244, 245
De Koninck, ii. 161
De la Beche, ii. 120, 282
Deshayes, i. 246, 249, 252, 302, 306, 458
Desor, ii. 250
D'Espagne, Count, i. 285
Dochart river, i. 48
Domo d'Ossola, i. 98
Donkin, Sir Rufane, i. 9
Dranse, devastations of, i. 91, 95
Drummond, Thomas, i. 154
Due d'Angoulême, i. 129
Duvan, i. 128, 149

EASTLAKE, Sir Charles, ii. 137
'Edinburgh Review,' ii. 122
Education in America, ii. 189
Egerton, Sir Philip, letters to, i. 265; ii. 73, 79, 90, 104
Ehrenberg, ii. 291
Electric telegraph, ii. 13, 14, 180
Elsa, lacustrine formation, i. 207
Embley, i. 13
Entomology, i 13, 17, 162, 167, 168 171, 173, 179, 195, 224, 279; ii. 206, 223
Erskine, Lord, ii. 7
Escher von der Linth, ii. 236, 225, 265
Esmenard, Madame, i. 147, 149
Etna, Mount, i. 217; ii. 303
Evolution, ii. 332
Ewald, ii. 230
Exhibition, Hyde Park, ii. 171, 173
—, New York, ii. 187

FALCONER, Dr., ii. 238, 254, 319, 335
Faraday, Michael, ii. 89, 138, 417

FER

Ferrara, i. 107
Férussac, Baron de, i. 139, 303
Fingal's grave, i. 49
Finhaven, i. 48
Fire-flies, i. 102
Fitton, Dr., i. 115, 122, 253, 319, 363, 387; ii. 40, 142; letter to, 47
Fleming, Rev. Dr., letters to, i. 178, 179, 253, 255, 256, 259, 263, 311, 315, 328, 396, 444; ii. 71, 208, 225
Florence, i. 110, 111
Fontainebleau, i. 64
Forbes, Edward, letter to, ii. 106; from, 110; death of, 155, 201, 204
—, J. D., ii. 264, 271
Forchhammer, Prof., i. 410, 413
Forfar, slate quarries, i. 48
Fowler, Dr., i. 13
Freshwaterformation, Central France, i. 184

GARDA, lake of, i. 101
Gefle, i. 434
Gemellaro, i. 217; ii. 298
Gastaldi, ii. 263
Geinitz, ii. 220, 224
Gemmi, i. 97
Geneva, i. 67
Getroz glacier, i. 93
Giant's Causeway, ii. 74
Gibbon, i. 76
Gibson, ii. 277
Giesbach, i. 85
Gifford's 'Juvenal,' i. 34
Giotto's frescoes, i. 203
Glacier de Bosson, i. 69, 73
Glaciers, ii. 250, 255
Goldau valley, i. 80
Gormire lake, i. 46
Graham island, i. 329
Granite in Norway, ii. 21
Gray, Professor Asa, ii. 341, 361
Greenough, G. B., i. 252, 327, 362
Grenville, Lord, i. 34
Greville, Dr. Robert K., i. 333
Grimsel, i. 86, 87, 97
Grindelwald, i. 88
Grove, Sir William, letters to, ii. 176, 177
Grylli, i. 95
Guidotti, Professor, i. 205
Guilding, Rev. Lansdown, i. 32, 54, 55
Gümbel ii. 234
Gutbier, ii. 221, 224

INV

HALL, Captain Basil, i. 158, 310, 349, 376; ii. 49
—, Sir James, i. 158
—, James, State geologist, ii. 184
Hallam, Henry, ii. 81, 128, 141
Hartung, George, ii. 191; letters to, 202, 232, 273, 282, 283
Hartz, geology of, ii. 162
Haswell Colliery, ii. 90, 417
Hambleton Hills, i. 45, 46
Haeckel, Professor, letter to, ii. 435
Head, Sir Edmund, ii. 178, 182
Headlam, Dr., i. 46
Heathcote, Sir Thomas, i. 13
—, Mrs., i. 13, 359
Heer, Professor Oswald, ii. 173, 208, 237, 246, 346, 349; letters to, 210, 350, 401, 406, 424, 444, 446, 449, 450
Helderberg war, ii. 57
Helmsley, i. 45
Henslow, Professor, i. 366; ii. 208
Herschel, Sir John, i. 181, 251, 356; letters to, 200, 449, 464, 470; ii. 11, 404
Highelere, i. 161
Holland, Lord, ii. 8
—, Lady, ii. 9
Hooker, Sir William, i. 40, 178, 181, 348; ii. 43, 153
—, Sir Joseph, ii. 146, 153, 196, 459; letters to, 204, 214, 326, 327, 361, 378, 410, 448
Horner, Leonard, i. 170; letters to, 257, 404, 405, 436; ii. 23, 37, 39, 41, 54, 60, 91, 98, 102, 105, 148, 155, 156, 160, 164, 178, 184, 191, 193, 198, 203, 205, 217, 220, 227, 233, 239, 243, 245, 249, 253, 255, 268, 268, 281, 350, 352, 356
—, Mrs., letter to, ii. 323
—, Miss, letters to, i. 319, 330, 339
Horner, Miss Susan, letters to, ii. 156, 175, 275, 333
Horsfield, Dr., i. 350
Humboldt, Alexander von, i. 43, 125, 126, 141, 146, 378
Humming-birds, ii. 413
Hutton, Dr., ii. 41, 48, 49, 281
Huxley, T. H., ii. 335, 351, 356, 363, 366

ICEBERGS, ii. 95, 103
Ichthyosaurus, discovery of, i. 153
Ignatius, letters of, ii. 167
Indian Mutiny, ii. 273
Inglis, Sir Robert, ii. 144
Insects, fossil, i. 195
Inverquharity, i. 341

INV

Iona, i. 51
Ischia, i. 209, 210, 211, 213

JACQUEMONT'S letters, ii. 10
Jamieson, Professor, i. 46
Jardin des Plantes, i. 59, 61, 63
Jeffrey, Francis, i. 159; ii. 155
Jones, Dr. Bence, letter to, ii. 417
Judd, Professor, ii. 456
Junius, ii. 136
Jura, i. 66

KEMBLE, Miss, i. 268
King's College lectures, i. 381
Kingsley, Rev. Charles, letter to, ii. 336
Kinnordy, i. 1, 2, 10, 39, 47
Kirriemuir quarry, i. 48
Knighthood, ii. 148

LAGO MAGGIORE, i. 99
Lake Basins, ii. 443
Lamarck, ii. 365
Lansdowne, Lord, ii. 115, 116, 118, 135, 143, 148
La Place, le Marquis de, i. 128; ii. 222
Latin verses, i. 25
Lauffen, castle of, i. 78
Le Coq, Monsieur, i. 187
Leonhard, Professor von, i. 390, 400
Lepsius, ii. 164
Lewis, George Cornewall, ii. 115
Liber Argenteus, i. 434
Limestone of Winchelsea, i. 119
Linnæa Borealis, ii. 18, 132, 146
Linnæus, i. 17, 431
Lockhart, John, i. 165, 352
—, Mrs., i. 166, 181, 357, 362
Lonsdale, William, i. 349; ii. 47, 160, 233
Louis XVIII., i. 59, 61
Louis Philippe, ii. 139
Lough, sculptor, ii. 141
Louvre, i. 63, 64
Lowell, John A., ii. 65, 80, 91, 173
Lyell, Charles, senior, letters to, i. 32, 34, 35, 36, 37, 40, 42, 52, 54, 117, 122, 123, 125, 126, 129, 132, 134, 135, 137, 140, 143, 147, 149, 153, 154, 165, 169, 180, 182, 183, 185, 188, 199, 202, 244, 288, 393, 400, 472; ii. 28, 29, 101, 114, 115, 120, 123, 129, 135, 152
Lyell, Mrs., his mother, letters to, i. 156, 189, 292, 390, 398

MOD

Lyell, Lady, letters to, i. 407; ii. 73, 190, 285, 302, 366, 368, 371
— Caroline, letters to, i. 172, 179, 191, 195, 205, 221, 251, 278, 291, 300, 308; ii. 10, 13, 103, 206, 223, 326, 357
— Eleanor, letters to, i. 156, 163, 197, 213, 262, 267, 285, 389; ii. 15, 18, 138, 346
— Fanny, letters to, i. 227, 280, 392
— Leonard, letters to, ii. 248, 347, 379
— Maria, letter to, i. 389
— Marianne, letters to, i. 112, 162, 166, 171, 193, 207, 216, 238, 248, 275, 295, 301, 312, 317, 397; ii. 64, 74, 79, 94, 95, 139, 149, 272, 339, 378
— Sophia, letters to, ii. 7, 24, 50, 316
— Thomas, R.N., i. 2, 3, 7, 10, 30; letter to, ii. 345
Lyndhurst, Lord, ii. 320

MACAULAY, T. B., ii. 33, 115, 154, 189, 279, 331
Maeculloch, i. 159
Mackenzie, Sir George, i. 156
Madeira, ii. 190
Mallet, J. L., ii. 54
— Mrs., i. 360, 371, 385
Malmaison, i. 60
Manfrini Palace, i. 106
Mansel's Bampton Lectures, ii. 321
Mantell, Dr. Gideon, letters to, i. 114, 116, 117, 119, 120, 151, 153, 160, 164, 168, 173, 175, 177, 246, 252, 253, 258, 261, 264, 306, 316, 318, 329, 367, 388, 395, 401, 442, 443, 447, 455, 462, 470, 471; ii. 58, 148
Mars, Mademoiselle, ii. 25
Martigny, i. 91, 94, 96
Martineau, Harriet, ii. 147
Mason, Laing, i. 47
Matterhorn, ii. 262
Mer de Glace, i. 71
Merian, Professor P., ii. 245
Merivale, Herman, i. 381; ii. 114, 279
Messina, ii. 296
Meyer, Hermann von, ii. 242, 245
Meyringen, i. 85, 87
Midhurst, i. 18, 30, 32, 34, 35, 42
Milan, i. 99, 100
Miller, Hugh, ii. 134, 205
Milman, Rev. Dean, i. 263; ii. 8, 29, 32, 114, 117, 126, 360
Mitscherlieh, ii. 203
Modern causes, i. 169

MOE

Moel Tryfaen, ii. 377, 379, 419
Moën, i. 410
Mont Blanc, i. 67
Mont Dore, i. 185, 190, 452
Montlosier, Count de, i. 188
Mont Pleureur, i. 93, 94
Montret, Baron C. de, i. 133, 138
Moore, John Carrick, letter to, ii. 77
— Miss, letter to, ii. 163
Mount Lebanon glacier moraines, ii. 329
Mull, i. 52
Murchison, Sir Roderick, i. 164, 184, 189, 197, 350, 357, 359, 373; letters to, 181, 210, 232, 234, 236, 239, 242
Murray, John, letter to, ii. 353
Murray of Simprim, i. 267, 301, 346

NAPIER, Sir Charles, ii. 273
—, Sir William, i. 327
—, Macvey, i. 333
Naples, i. 215
Napoleon, picture by Haydon, ii, 52, 124
Natural Selection, ii. 363
Necker, i. 246, 351
Nelson, Lord, i. 5, 45, 49
Neptune, Temple of, i. 214
Niagara Falls, ii. 58, 61
Nicolosi, ii. 303
Nismes, i. 196
Norfolk Crag, ii. 41
Northampton, Lord, i. 230, 237, 241
Norway, prosperity of, ii. 19
Norwich, i. 41, 43; ii. 42
Nova Scotia, ii. 180

OBAN, i. 49, 52
Oersted, i. 449
Ogilvie, Captain, i. 154, 157
Olbers, Professor, ii. 21
Olot, i. 281, 283, 284, 290, 326
'Origin of Species,' ii. 325, 437
Osborne, ii. 190, 367
Owen, Professor, ii. 93, 145
Oxford, i. 32

PADUA, i. 102, 107
Palermo, i. 226
Palmieri, ii. 292
Paretto, i. 242.
Paris, i. 59, 149
Peel, Sir Robert, ii. 51, 139, 141
Pengelly, William, letters to, ii. 382, 402

SAL

Père la Chaise, i. 62
Petworth marble, i. 121
Phillips, Professor, ii. 40, 281
Pichon, Madame, i. 132, 135, 138
—, Monsieur, i. 135, 138, 146, 149
Pillans, Professor, i. 333
Plesiosaurus, i. 153
Politics, French, i. 145
—, American, ii, 62, 84, 97
Pompeii, i. 214
Pontgibaud excavations, i. 186
Prescott, W. H., memoirs of, ii. 359, 382
Prévost, Constant, i. 134, 137, 144, 153, 247, 248, 257, 302
Prince Albert, ii. 148, 156, 158, 171, 175, 190, 334, 353
Prince of Wales, ii. 157
Princess Alice, ii. 369, 374
'Principles of Geology,' i. 258, 269
Puycerda, i. 278, 286
Puy de Dôme, i. 192
Puy en Velay, i. 193
Pyrenees geology, i. 297

'QUARTERLY REVIEW,' i. 300
Queen, the, ii. 33, 142, 373, 375
Quenstedt, ii. 236

RAFFLES, Sir Stamford, i. 55
Rajah Brooke, ii. 383
Ramsay, Sir James, i. 30, 39, 48, 64, 340
Redcliffe, Dr., i. 7, 8, 10
Redouté, i. 143, 147
Reform Bill, i. 383
'Reign of Law,' ii. 413
Repudiation, ii. 67
Rhone glacier, i. 87
Ricasoli, i. 237, 240
Righi, i. 80, 83
Ringwood, i. 3, 6, 10
Ripple-mark, i. 299
Ritten earth-columns, ii. 405
Rogers, Samuel, i. 470; ii. 31, 33, 34 114, 123, 125, 136
Rome, i. 112, 209; ii. 275
Romney Marsh, i. 117
Rossberg, i. 80
Rosse, Lord, ii. 76
Royal Society, ii. 145
Russell, Lord John, ii. 156
Ryan, Sir Edward, ii. 142, 459

SALISBURY, i. 7, 8, 10, 17
Salzburg, ii. 260

SAR

Sarnen, i. 84
Sarum, Old, i. 9, 10, 13
Scacchhi, ii. 203, 274, 296
Schaffhausen, i. 78
Schmerling, i. 401
School-fight, i. 20
Schumacher, Professor, i. 408
Scott, Sir Walter, i. 165, 359
Scrope, George Poulett, i. 163, 170; letters to, 268, 272, 273, 283, 296, 304, 309
Sedgwick, Rev. Adam, i. 199, 251, 256, 269, 374; letters to, 450, 457, 460, ii. 2, 10; letters to, 35, 72
Sembranchier, i. 92 96
Serapis, Temple of, ii. 290
Seward, Hon. William H., ii. 56
Shielhill, bridge of, i. 48
Sidlaw Hills geology, i. 154
Siena fossils, i. 241
Senior, Nassau, ii. 172
Simplon, i. 98
Sismonda, Professor Angelo, ii. 145, 268
Slavery, ii. 100
Smith, Sir James Edward, i. 41
—, Sydney, ii. 30, 122
Smyth, Admiral, i. 172, 370
—, Mrs. i. 167
Soleure quarries, ii. 249
Somerville, Mrs., i. 180, 322, 325, 352, 366, 373; ii. 273
Somma, ii. 274, 293
Species, doctrine of, ii. 215
Spedding, T. S., i. 167, 379; letter to, ii. 375
Staël, Madame de, i. 321, 325; ii. 126
Staffa, i. 49, 55
St. Bernard, i. 96
Stalden earth-pillars, ii. 404
Stanley, Dr., Bishop of Norwich, ii. 42, 121
—, Rev. A. P., Dean of Westminster, ii. 143, 368, 459
Stockholm, i. 426, 429
Stokes, Charles, i. 247, 274, 357, 368
Stur, Professor, ii. 228
Sully's country house, ii. 27
Superga, ii. 267
Symonds, Rev. W. S., ii. 206; letters to, 337, 376, 416, 423, 430, 434

TARGIONI, Professor, i. 206
Telescope of Lord Rosse, ii. 76

WIN

Tertiary classification, ii. 23
Theatres in America, ii. 133
Ticknor, George, letters to, ii. 66, 80, 84, 87, 91, 94, 118, 121, 124, 128, 132, 134, 154, 167, 170, 171, 187, 278, 318, 320, 329, 340, 351, 359, 382, 411, 445
Tractarianism, ii. 171
Transmutation theory, ii. 361
Trevelyan, Sir Walter, ii. 201
Turner, Dawson, i. 32, 40, 42, 43, 44, 53, 356
Tyndall, Dr., ii. 455
Tyndrum, i. 49

UNIFORMITY doctrine, ii. 2
Universities, ii. 87, 127, 143
Upsala, i. 430

VAL del Bove, ii. 315
Vallais, i. 98
Van Breda, Professor, i. 148
Venice, i. 103, 195
Verona, i. 101
Versailles, i. 144
Vesuvius, i. 212; ii. 292
Vicenza, i. 102
Villèle, Minister of France, i. 227, 295
Vivarrais, i. 194, 283
Viviani, i. 242, 243, 246
Von Buch, i. 451, 455; ii. 21, 24, 48, 194, 204
Von Hoff, i. 269, 272
Von Oeynhausen, i. 333
Vosges Mountains, i. 391

WALLACE, Alfred, letter to, ii. 413
Warburton, Henry, i. 122
Webster, Daniel, ii. 185
Wedel-Jarlsberg, Count, ii. 20
Wellington, Duke of, ii. 114
Whately, Dr., ii. 76, 149
Wheatstone, Professor, ii. 13, 14
Whewell, Rev. W., i. 272, 312, 351, 355; ii. 11, 32, 38, 127; letters to, 11, 32, 38, 127
White, Rev. Blanco, ii. 92, 94, 168
Wight, i. 120
Winchelsea, 119
Winchester, i. 18, 21, 26

WIT

Wittenbach, Dr., i. 89
Wollaston, Dr., i. 115, 238
—, ii. 208, 211, 223, 282
Worms, city of, i. 399
Wrottesley, Sir John, i. 81, 83
Wyman, Dr., ii. 183, 186

ZWE

YARMOUTH geology, i. 42, 53

ZERMATT, ii. 259
Zürich, i. 79
Zwerglethurm, ii. 271

THE END.

LONDON : PRINTED BY
SPOTTISWOODE AND CO., NEW-STREET SQUARE
AND PARLIAMENT STREET